Clinical and Imaging Features of Transient Ischaemic Attack and the Utility of ABCD^2 Score

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CERTIFICATE

This is to certify that this dissertation entitled ***"Clinical and Imaging Features of Transient Ischaemic Attack and the Utility of ABCD² Score"*** *submitted by* ***Dr Karthik S N*** *appearing for* ***D.M.,*** *Degree examination in* ***August 2010*** *is a bona fide record of work done by him under my direct guidance and supervision in partial fulfillment of regulations of the Tamil Nadu Dr. M.G.R. Medical University, Chennai. I forward this to the Tamil Nadu Dr.M.G.R. Medical University, Chennai, Tamil Nadu, India.*

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DECLARATION

I, Dr KARTHIK S N, do solemnly affirm that this dissertation titled **"Clinical and Imaging Features of Transient Ischaemic Attack and the Utility of ABCD^2 Score"** is a bona fide work done by me at Institute of Neurology, Madras Medical College & Govt. General Hospital, Chennai, during 2007-2010 under the guidance and supervision of **Dr R M Boopathy M.D., D.M., Professor of Neurology, Institute of Neurology**

The dissertation is submitted to The Tamilnadu Dr. M.G.R. Medical University towards the partial fulfillment of requirements for the award of **D.M., degree in Neurology.**

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ABBREVIATIONS AND ACRONYMS

- ACA : Anterior Cerebral Artery.
- AICA : Anterior Inferior Cerebellar artery
- AF : Atrial Fibrillation.
- BA : Basilar Artery
- BP : Blood Pressure
- DM : Diabetes mellitus
- DWI : Diffusion Weighted imaging
- HDL : High Density Lipoproteins
- HT : Hypertension
- ICA : Internal Carotid Artery
- LDL : Low Density Lipoproteins
- MCA : Middle Cerebral Artery
- MRI : Magnetic Resonance Imaging
- mRS : Modified Ranikin Score
- NECT : Non Enhanced Computerized Tomogram
- NIHSS : National Institute of Health Stroke Scale
- PCA : Posterior Cerebral Artery
- PICA : Posterior Inferior Cerebellar artery
- SCA : Superior Cerebellar Artery
- TIA: : Transient Ischemic Attacks
- TGL : Triglycerides

KEY TO MASTER CHART

A	:	Aphasia
AF	:	Atrial Fibrillation
AD	:	Arterial Disease
Amx	:	Amaurosis Fugax
Atx	:	Ataxia
B	:	Both
CD	:	Cardiac Disease
D	:	Dysarthria
DM	:	Diabetes Mellitus
Dip	:	Diplopia
FB	:	Facio Brachial Monoparesis
F	:	Female
HA	:	Hemianopia
HT	:	Hypertension
L	:	Left
LOC	:	Loss of Consciousness
M	:	Male
N	:	No
N & V	:	Nausea and Vomiting
P	:	Posterior Circulation
R	:	Right
U	:	Undetermined
Vt	:	Vertigo
Y	:	Yes

INTRODUCTION

Cerebrovascular disease is the third leading cause of death in developed countries after heart disease and cancer; the overall prevalence is 794 per 100,000. It is estimated that more than 700,000 patients have a stroke each year in the United States. The loss of these patients from the work force and the extended hospitalization they require during recovery make the economic impact of the disease one of the most devastating in medicine.

About 15-20% of patients with stroke have a preceding TIA, making it one of the common neurologic problems. Four to 20 percent of patients who have a TIA, experience a stroke within the following 90 days; one half of those strokes occur within 48 hours. Promptly recognizing patients who are at high risk of progressing to stroke provide us a golden opportunity for stroke prevention. This depends upon accurately identifying the cause of symptoms, and the nature, location, and severity of causative cardiac, hematologic, and cerebrovascular abnormalities.

TIA being a clinical diagnosis, there is a significant variation among physicians and neurologists in diagnosing this condition. In one series, majority (81%) of the TIA referrals from general practitioners to neurology clinics were for nonvascular events. Even the percent agreement among two neurologists for the diagnosis of TIA by history varies from 42% to 86%. In such a situation development of a scoring system like ABCD2, not only helps in triaging the patients but also acts as a tool in diagnosing and

further assessing these patients. Although there are studies regarding stroke, currently there are no big studies from India regarding the clinical and imaging features in patients with TIA. Also ABCD2 score as a tool is not being routinely used even by the Neurologist.

Considering the limited information available from India, this study was undertaken to determine the utility of ABCD2 scoring system in Indian population and to determine the differences in risk factors and clinical profile if any, when compared to western population.

Aims and Objectives

1. To analyze the risk factors and clinical profile of transient ischemic attack.

2. To study the imaging feature in transient ischemic attack.

3. To evaluate the utility of $ABCD^2$ score in predicting long-term survival and stroke risk after TIA

4. To assess the treatment outcome of transient ischemic attack.

LITERATURE REVIEW

INTRODUCTION — Transient ischemic attack (TIA) is a brief episode of neurologic dysfunction resulting from focal temporary cerebral ischemia not associated with cerebral infarction.TIA was originally defined clinically by the temporary nature (< 24 hours) of the associated neurologic symptoms. However, the arbitrary nature of the 24-hour time limit and lack of specific pathophysiologic meaning hampered the clinical and research utility of the term "TIA." Recognition of these problems led to a change to a tissue-based definition of TIA. The change was driven by advances in neuroimaging that enabled very early identification of ischemic brain injury.

MODERN DEFINITION — As endorsed by 2009 guidelines from the American Heart Association and American Stroke Association (AHA/ASA), transient ischemic attack (TIA) is now defined as a transient episode of neurologic dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction [1]. In keeping with this definition of TIA, ischemic stroke is now defined as an infarction of central nervous system tissue.

TIA was originally defined as a sudden onset of a focal neurologic symptom and/or sign lasting less than 24 hours, presumably brought on by a transient decrease in blood supply, which rendered the brain ischemic in the area producing the symptom. However, this classic definition of TIA was inadequate for several reasons. Most notably, there is risk of permanent tissue injury (ie, infarction) even when focal transient neurologic symptoms

last less than one hour. Thus, the benign connotation of "TIA" has been replaced by an understanding that even relatively brief ischemia can cause permanent brain injury.

The advantages of modern tissue-based definitions of TIA and stroke include the following [1,2]

- The defined end point is biologic (tissue injury, as confirmed or excluded by neuroimaging) rather than arbitrary (24 hours).
- The definition encourages use of neurodiagnostic tests to identify brain injury and its cause.
- The presence or absence of ischemic brain is more accurately reflected.

An earlier proposal for a tissue-based TIA definition noted that clinical symptoms of TIA typically last less than one hour [2]. While this is true, the AHA/ASA did not incorporate the phrase "typically less than one hour" in the new definition of TIA because there is no time cutoff that reliably distinguishes whether a symptomatic ischemic event will result in ischemic infarction [1].

Use of the new definitions in epidemiologic studies is likely to modestly alter the incidence and prevalence rates of TIA and stroke, but these changes are encouraged by the AHA/ASA because they should reflect more accurate diagnosis [1]. One study estimated that switching from the classic to the tissue-based definition of TIA could reduce the annual incidence of TIA in the United States by 33 percent (range 19 to 44 percent) and increase the annual incidence of stroke by 7 percent (range 4 to 10 percent) [3].

OTHER TERMINOLOGY — The terms "acute neurovascular syndrome" and "transient symptoms with infarction" (or "cerebral infarction with transient signs") have been proposed to supplement TIA in the description of transient symptoms related to ischemia.

Acute neurovascular syndrome — With the new tissue-based definitions of stroke and TIA, there may be uncertainty regarding the diagnosis if immediate neuroimaging is not available to detect infarction when transient symptoms of brain ischemia occur [1]. The AHA/ASA has proposed (but not formally endorsed) consideration of a term such as "acute neurovascular syndrome" that can be used in this setting if a diagnostic evaluation is not performed or until the diagnostic evaluation is completed.

Transient symptoms with infarction — The awareness that a classically defined TIA (<24 hours in duration) can be associated with irreversible ischemic brain injury led to a proposal to label these events as "transient symptoms associated with infarction" (TSI) or "cerebral infarction with transient signs" and to distinguish them from transient symptoms without infarction [4].

While TSI in general has smaller infarct volumes than classically defined ischemic stroke (where neurologic deficits persist for ≥ 24 hours), there is no unique size that differentiates TSI from ischemic stroke [4].

Patients with TSI have a higher short-term risk of recurrent ischemic stroke than patients who have transient symptoms without infarction. This conclusion is supported by a number of head CT and DWI studies [4-8].

RELATIONSHIP OF SYMPTOM DURATION AND INFARCTION — A classically defined TIA with symptoms lasting for as little as a few minutes can be associated with infarction, whereas a spell lasting for many hours may rarely cause no signal changes on diffusion-weighted MRI imaging (DWI).

Some reports suggest that increased duration of classically defined TIA (<24 hours in duration) is associated with a higher probability of infarction on DWI, but the association is not absolute [4,9-12]. A systematic analysis of patients with classically defined TIA found that symptom duration was not a reliable predictor for the presence of infarction (figure 1), even though the mean duration tended to be significantly longer in patients with infarction than in those without infarction [4].

One potential caveat is that abnormalities on initial imaging such as diffusion-weighted (DWI) MRI obtained during or soon after symptoms, may actually be reversible injuries. However, most patients with TIA seek medical attention after their symptoms fully resolve; a low proportion (≤ 7 percent) of patients with classically defined TIA are admitted and scanned at the height of their symptoms [5,9-11]. Therefore, infarcts observed in patients with classically defined TIA most likely represent permanent brain injury, as the probability of DWI reversibility decreases as the time from symptom onset to imaging increases.

Temporal behavior of symptoms in patients with transient ischemic attack (TIA)

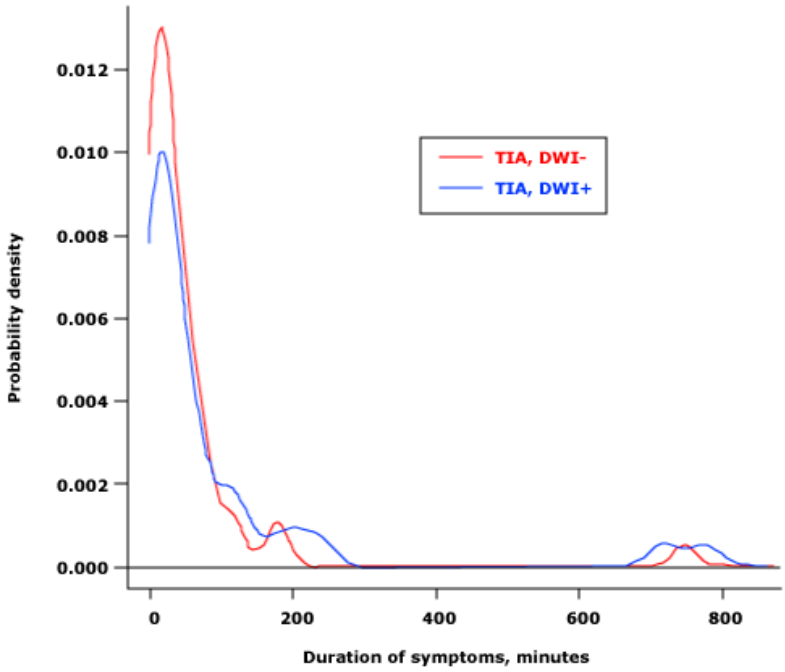


Figure 1. The probability density function curve of symptom duration for transient symptoms associated with infarction (TSI) indicates the absence of continuity within the first 24 hours. The probability density function is the probability that the variable takes a value in a given interval and is equal to 1 over its entire range of values. The area under curve is almost equal to 1 at around 200 minutes. Also note that the curves for TIA with or without infarction overlap (p = 0.82). The distribution of duration of symptoms as seen here suggests that symptom duration is not a reliable feature to be used for predicting whether a transient neurological spell is associated with infarction.
DWI: diffusion-weighted magnetic resonance imaging.

DWI is advantageous for evaluating patients who have transient symptoms because it is highly sensitive for detecting infarction, thereby confirming an ischemic cause. A systematic review found that DWI detects corresponding appropriate ischemic lesions in 16 to 67 percent of patients with classically defined TIA [13]. Also, the combination of DWI with MRI and MRA often provides clues to the underlying pathophysiology.

DWI also has an advantage in differentiating acute infarction from chronic lesions. One study estimated that the amount of error potentially imposed by the use of conventional MRI in identifying the clinically responsible infarct in patients with classically defined TIA could be as high as 50 percent when compared with DWI [5]. This is, in large part, because infarctions associated with classically defined TIA are often very small. A volumetric study of TIA-related infarcts showed that 96 percent of all infarcts were smaller than 1 mL [4]. The smallest single lesion that was associated with a classically defined TIA was 0.17 mL in volume. The mean infarct volume was 0.66 ± 1.20 mL.

Perfusion-weighted MR imaging (PWI), when used in combination with DWI, may improve the accuracy of diagnosis in patients with transient ischemic symptoms [14,15]. This is illustrated by a prospective series of 43 patients with classically defined TIA who had both studies performed within 48 hours of symptoms onset [15]. Lesions on DWI only, PWI only, or both DWI and PWI were observed in 19, 16, and 16 percent of patients, respectively. Thus, objective evidence of brain ischemic with either DWI or PWI lesion was present in 51 percent.

INCIDENCE — Transient ischemic attack (TIA) is a common neurologic problem. In a mainly white population from Rochester Minnesota, a population-based study reported that the incidence rate of TIA was 68 per 100,000 [16]. In the Cincinnati and Northern Kentucky region of the United States, where the ethnic and socioeconomic demographics are similar to that of the United States as a whole, another population-based study found that the adjusted incidence rate for TIA was 83 per 100,000 people, and that blacks and

men had significantly higher rates of TIA than whites and women [17]. From these data, it was estimated that 240,000 TIAs occur each year in the United States.

The incidence of TIA in other populations has generally been lower than that reported in the United States, ranging from about 10 to 56 per 100,000 in various studies worldwide [18-21].

PATHOPHYSIOLOGIC MECHANISMS — A transient ischemic attack (TIA) should be considered a syndrome. These syndromes are conveniently divided into three pathophysiologic mechanisms: Large artery low-flow TIA (true TIA) Embolic TIA, which may be artery-to-artery, or due to a cardioaortic or unknown source Lacunar or small penetrating vessel TIA

Large artery low flow TIA — Large artery low-flow TIAs are brief (usually minutes to a few hours), recurrent, and stereotyped. They are often associated with a tightly stenotic atherosclerotic lesion at the internal carotid artery origin or in the intracranial portion of the internal carotid artery (siphon) when collateral flow from the circle of Willis to the ipsilateral middle or anterior cerebral artery is impaired (figure 2 and figure 3). Other important causes include atherosclerotic stenotic lesions in the middle cerebral artery stem (figure 4) or at the junction of the vertebral and basilar artery. Any obstructive vascular process in the extracranial or intracranial arteries can cause a low-flow TIA syndrome if collateral flow to the potentially ischemic brain also is impaired.

Anatomy of the cerebral arterial circulation

Embolic TIA — Embolic TIAs are characterized by discrete, usually single, more prolonged (hours) episodes of focal neurologic symptoms. As an example, in one study

that divided patients with TIAs into those with symptoms of short duration (less than 60 minutes) or long duration (60 minutes or greater), the latter group was much more likely to have an embolic source (86 versus 46 percent) [22]. The embolus may arise from a pathologic process in an artery, usually extracranial, or from the heart (eg, atrial fibrillation or left ventricular thrombus). An ischemic stroke with infarction has occurred if symptoms or signs persist beyond 24 hours. However, as previously mentioned, symptoms that last less than 24 hours (often only as long as one hour) also may be associated with some infarction. If the primary pathologic process is thought to be embolic, a diligent search for its source is necessary before therapy to prevent future stroke can be initiated.

Lacunar TIA — Lacunar or penetrating or small vessel TIAs are due to transient cerebral ischemia induced by stenosis of one of the intracerebral penetrating vessels arising from the middle cerebral artery stem, the basilar or vertebral artery (figure 5), or the circle of Willis (figure 2 and figure 3). Occlusion of these small intracerebral penetrating vessels usually is due to lipohyalinosis from hypertension, but also may arise because of atheromatous disease at their origin. Occasionally, recurrent stereotyped TIAs occur; in this setting, the term lacunar or small vessel TIAs seems appropriate.

CLINICAL MANIFESTATIONS — The symptoms of a transient ischemic attack (TIA) depend upon the pathophysiologic subtype.

Low-flow TIA — Low-flow TIAs usually are short-lived (minutes) and often recurrent. They may occur as little as several times per year but typically occur more often (once per week or up to several times per day).

Low-flow TIAs are generally stereotyped, especially when they are due to hemodynamically significant stenotic lesions at the origin of the internal carotid artery, at the siphon portion of the internal carotid artery where collateral flow to the circle of Willis is inadequate, or in the middle cerebral artery stem. Symptoms due to ischemia from these lesions often include hand, arm, leg, face, tongue, or cheek numbness or weakness together, or a combination of one or more. Recurrent aphasic syndromes appear when there is focal ischemia in the dominant hemisphere, and recurrent neglect occurs in the presence of focal or nondominant hemisphere ischemia.

In contrast, recurrent symptoms are often not stereotyped when the stenotic lesion that obstructs flow involves the vertebrobasilar junction or the basilar artery. The many closely packed neuronal structures in the brainstem preclude consistent manifestations of recurrent focal ischemia in this area.

Nevertheless, certain generalizations about recurrent low-flow TIA symptoms in the posterior circulation can be made. Obstructive lesions in the distal vertebral artery or at the vertebrobasilar junction usually cause disorganized dizziness that may or may not include spinning or vertigo. The patient may complain that the room is tilting or that the floor is coming up at them, rather than spinning dizziness. Patients most often use the word dizziness to describe a myriad of symptoms, not necessarily spinning. Other symptoms may include numbness of one side of the body or face, dysarthria, or diplopia. Ischemia in the pons from stenotic lesions in the proximal to midbasilar artery can cause bilateral leg and arm weakness or numbness and a feeling of heaviness in addition to dizziness. Patients often say it feels as though all of their energy has been drained. They

may speak of a feeling of impending doom. Ischemia in the territory of the top of the basilar artery or proximal posterior cerebral artery may present with all of the above recurrent symptoms as well as overwhelming drowsiness, vertical diplopia, eyelid drooping, and an inability to look up. Transient ischemia at the top of the basilar artery is usually due to embolism rather than low-flow TIA.

Embolic TIA — Embolic TIAs typically last hours rather than minutes as in low-flow TIAs. They may be infrequent since they are the result of emboli from a specific source (eg, a one, two, or three-time phenomenon). When the source of the embolus is in a proximal vessel, recurrent emboli can lodge in different branches of the parent vessel giving different symptoms.

Emboli are subject to natural thrombolysis and migration since they typically break off of fresh thrombus. They may produce transient ischemia on many occasions, but an element of silent infarction remains. Emboli may be better referred to as acceptable minor embolism (ACME), a term coined by C Miller Fisher.

Embolic TIAs are best divided into those in the anterior cerebral circulation (carotid, ACA, MCA territory) and those in the posterior cerebral circulation (vertebrobasilar, posterior cerebral artery territory). Symptoms in both circulations depend upon the size of the embolic fragment in relation to the size of the artery occluded.

Embolic TIAs in the anterior circulation may be large enough to occlude the middle cerebral artery stem, producing a contralateral hemiplegia secondary to ischemia in the deep white matter and basal ganglion/internal capsule lenticulostriate territory (figure 6). In addition, they may produce cortical surface symptoms when pial collateral flow is

inadequate. These include aphasic syndromes in the dominant hemisphere and anosognosia or neglect in the nondominant hemisphere.

Smaller emboli that occlude branches of the middle cerebral artery stem result in more focal symptoms, including hand alone or arm and hand numbness, weakness, and/or heaviness induced by ischemia to the frontal area of the contralateral frontal lobe motor system (figure 4). The symptoms also may be as specific as thumb or hand numbness or a swollen feeling, suggesting focal ischemia in the hand area of the sensory strip or parietal association cortex. Transient unilateral visual obstruction often signifies atherothrombotic disease in the internal carotid artery proximal to the ophthalmic artery takeoff. Atherothrombotic disease is most often responsible for these syndromes, although carotid dissection and embolism from the aorta, heart, or an unknown source also should be considered.

Posterior circulation territory embolic TIAs are generally produced by emboli arising from atherothrombotic disease at the origin or distal segment of one of the vertebral arteries or of the proximal basilar artery. Emboli arising from the aortic arch, the heart, an unknown source, or from a dissecting lesion in the vertebral artery should also be considered.

Symptoms vary according to the vertebral or basilar artery branch in which the emboli lodges (figure 7). Emboli can produce transient ataxia, dizziness, diplopia, dysarthria, quadrantanopsia, hemianopsia, numbness, crossed face and body numbness, and focal hearing loss. When the top of the basilar artery is embolized, sudden, overwhelming stupor or coma may ensue due to bilateral medial thalamic, subthalamus, and medial

rostral midbrain reticular activating system ischemia. Emboli in the more distal branches of the posterior cerebral artery may result in a homonymous field defect or in memory loss (inferior medial temporal lobe ischemia).

Lacunar or small vessel TIA — Lacunar or small vessel TIAs are thought to be caused by atherothrombotic obstructive lesions at the origin of the penetrating vessel or lipohyalinosis distally. Embolism is rarely proposed as the mechanism. These small vessel TIAs cause symptoms that are similar to the lacunar strokes that are likely to follow. Thus, face, arm, and leg weakness or numbness due to ischemia in the internal capsule, pons, or thalamus may occur, similar to the symptoms due to ischemia from embolism or large vessel atherothrombotic disease or dissection. As a result, serious disease in the parent vessel must be excluded before the diagnosis of lacunar or small vessel TIA can be established with confidence.

Lacunar infarcts may be preceded by lacunar TIAs consisting of brief repetitive stereotyped clinical symptoms and signs, and lacunar stroke onset may be stepwise and progressive rather than abrupt [23-25]. Such a pattern of TIAs, or nonsudden onset in association with a lacunar syndrome, is highly suggestive of small vessel lipohyalinotic etiology [26].

IMPORTANT PATHOLOGIC PROCESSES — There are four pathologic processes that give rise to low-flow "true" TIAs or embolic TIAs and that can produce sudden devastating stroke if not recognized and treated. Atherothrombotic stenotic lesions at the origin of the internal carotid artery that are narrowed more than 70 percent Intracranial atherothrombotic disease that produces low-flow or embolic TIA due to lesions at the

distal vertebral artery/vertebrobasilar junction/proximal basilar artery Emboli to the top of the basilar artery or the middle cerebral artery stem that come from a source below, either arterial, aortic, or cardiac Dissection lesions at the origin of the petrous portion of the internal carotid artery or at the C1-2 level of the vertebral artery as it enters the foramen transversarium

Internal carotid artery TIA — An atherothrombotic stenotic lesion at the origin of the internal carotid artery that is narrowed to more than 70 percent of its normal lumen diameter poses a threat of embolic or low-flow TIA or stroke [27-30]. Even a 50 percent stenosis may be important when considering carotid endarterectomy for prevention of a secondary stroke or of a primary stroke when a TIA has occurred.

Prospective natural history studies of asymptomatic atherothrombotic disease at the origin of the internal carotid artery (mostly asymptomatic carotid artery bruits) suggest that the rate of ipsilateral stroke increases dramatically when the residual lumen diameter narrows to greater than 70 percent stenosis (figure 8 and figure 9) [31-33]. In one series of 500 patients, for example, the incidence of stroke was 1.7 percent per year overall but 5.5 percent per year in those with more than a 75 percent carotid artery stenosis [32].

This degree of stenosis corresponds to a residual lumen diameter of 1.5 mm, the precise point at which pressure drops across the stenotic lesion [34,35]. When the pressure drops, flow to the ipsilateral middle cerebral artery stem is in part supplied by collateral circulation from the circle of Willis and from the external carotid to ophthalmic to distal internal carotid artery system (figure 2 and figure 3). Less flow is provided by the internal carotid artery as the lesion further narrows. It is believed that this provides a milieu for

thrombus formation at the site of the stenosis and subsequent embolism. When the circle of Willis is compromised, low-flow "true" TIA ensues.

Intracranial atherothrombotic disease — Intracranial atherothrombotic disease that produces low-flow or embolic TIA most commonly occurs at the distal vertebral artery/vertebrobasilar junction/proximal basilar artery site. The potential of this lesion to precipitate a disastrous stroke by thrombosis, thrombus propagation, and embolism is extremely important. The other two most important, but less common, sites include the siphon portion of the internal carotid artery and the middle cerebral artery stem. The common carotid origin and the vertebral artery origin are much less problematic since they only rarely give rise to artery-to-artery emboli.

The ability to noninvasively diagnose and follow these intracranial arterial lesions with precision through MRI angiography, duplex Doppler, and transcranial Doppler flow assessment allows for important preventive therapeutic considerations.

Arterial, aortic, or cardiac sources of emboli — Emboli at the top of the basilar artery or in the middle cerebral artery stem that come from a source below — arterial, aortic, or cardiac — are extremely important to recognize since they may produce fluctuating symptoms or TIAs prior to a devastating stroke. Transient focal symptoms due to an embolus at these sites occur because blood flow reestablishes itself around the embolus.

The symptoms may return in abundance and produce a stroke when the embolus itself causes a thrombus that further occludes the artery. This can occur hours or even days after the embolus has lodged at the site because it did not migrate or lyse. Acute antithrombotic therapy with heparin may be highly effective in preventing this thrombus

propagation and provide the time for spontaneous thrombolysis, although this has not been proven definitively.

Dissection lesions — Dissection lesions at the origin of the petrous portion of the internal carotid artery or at the C1-2 level of the vertebral artery as it enters the foramen transversarium cause symptoms of cerebral ischemia due to low flow or embolism, which occur within minutes, hours, or even days prior to a devastating stroke. Modern Doppler and neurologic imaging technology can establish the diagnosis noninvasively with the necessary precision to permit potentially stroke-saving therapeutic strategies (eg, intravenous heparin).

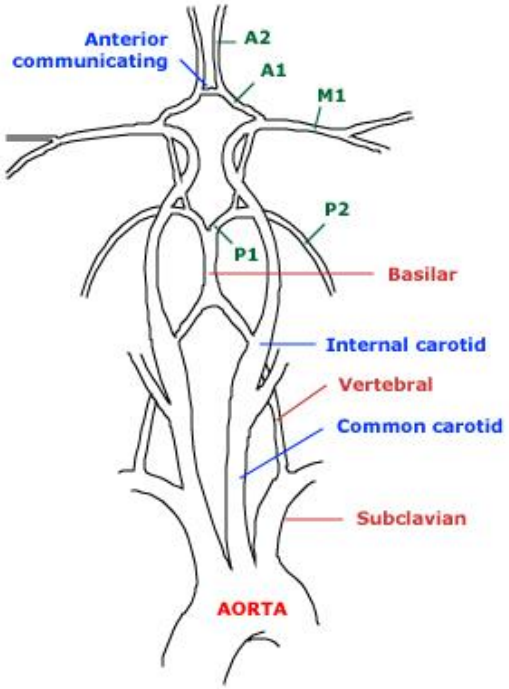


Figure 2. Anatomy of the cerebral arterial

Coronal section of cerebral hemisphere

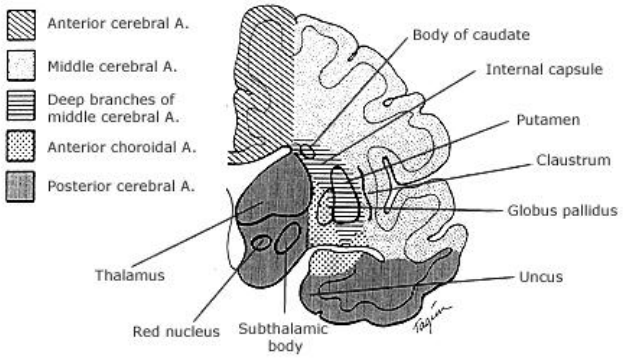
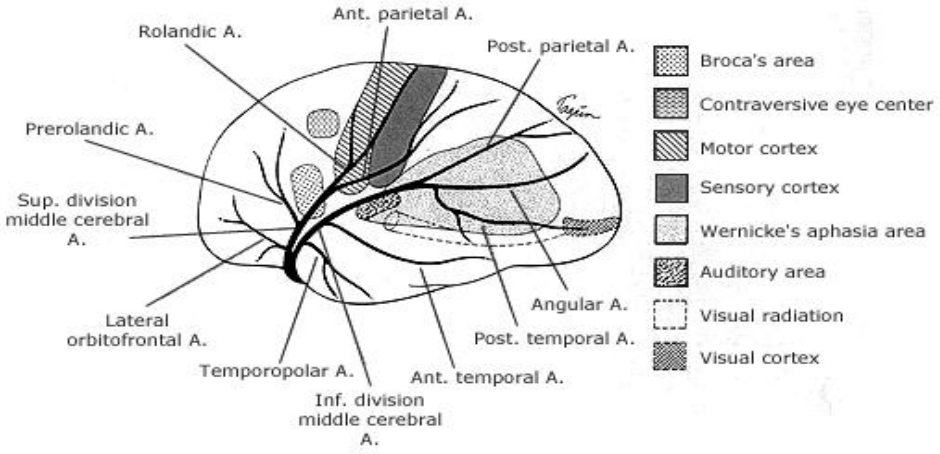
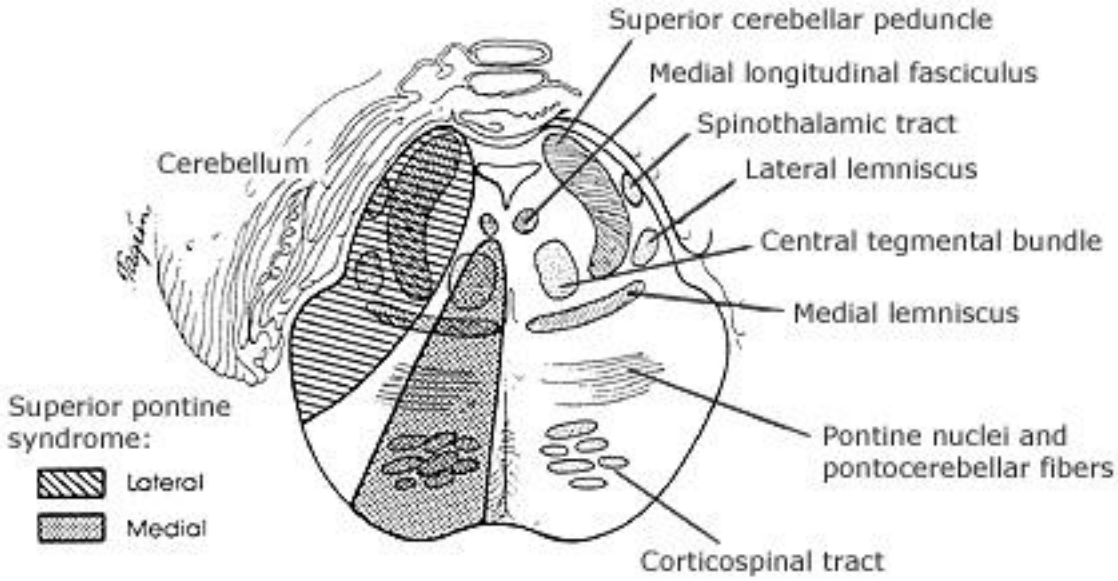


Figure 3.Representation of the territories of the major cerebral vessels circulation



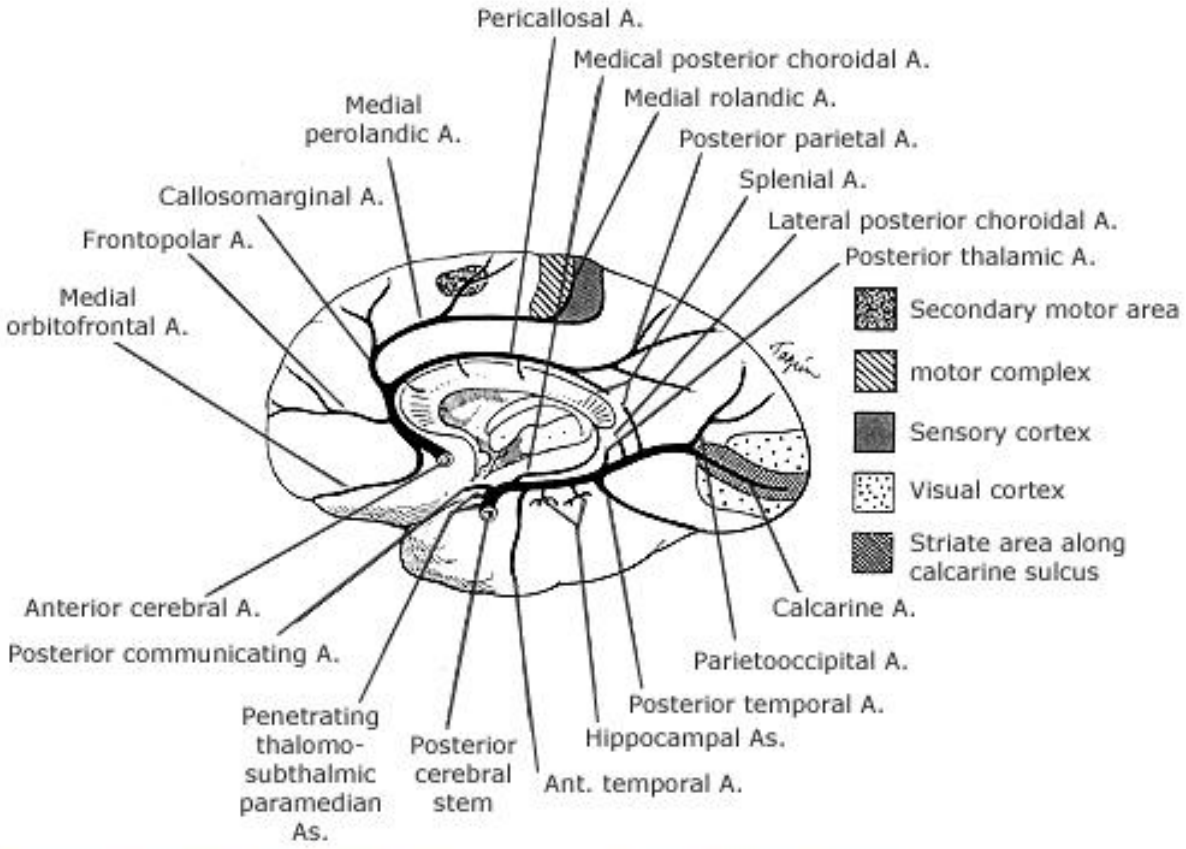
Signs and symptoms of occlusion	Structures involved
Paralysis of contralateral face, arm, and leg; sensory impairment over the same area (pinprick, cotton touch, vibration, position, two-point discrimination, stereognosis, tactile localization, barognosis, cutaneographia	Somatic motor area for face and arm and the fibers descending from the leg area to enter the corona radiata and corresponding somatic sensory system
Motor aphasia	Motor speech area of the dominant hemisphere
Central aphasia, word deafness, anomia, jargon speech, sensory agraphia, acalculia, alexia, finger agnosia, right-left confusion	Central, suprasylvian speech area and parieto-occipital cortex of the dominant hemisphere
Apractognosia of the minor hemisphere (amorphosynthesis), anosognosia, hemisomatognosia, unilateral neglect, agnosia for the left half of external space, dressing "apraxia," contstructional "apraxia," distortion of visual coordinates, innacurate localization in the half field, impaired ability to judge distance, upside-down reading, visual illusions	Nondominant parietal lobe (area corresponding to speech area in dominant hemisphere); loss of topographic memory is usually due to a nondominant lesion, occasionally to a dominant one
Homonymous hemianopsia (often homonymous inferior quadrantonopsia	Optic radiation deep to second temporal convolution
Paralysis of conjugate gaze to the opposite side	Frontal contraversive field or fibers projecting therefrom

Figure 4. Middle cerebral artery distribution and signs and symptoms of occlusion



Signs and symptoms of occlusion	Structures involved
Medial superior pontine syndrome (paramedian branches of upper basilar artery)	
On side of lesion:	
Cerebellar ataxia (probably)	Superior and/or middle cerebellar peduncle
Internuclear ophthalmoplegia	Medial longitudinal fasciculus
Myoclonic syndrome, palate, pharynx, vocal cords, respiratory apparatus, face, occulomotor, etc..	Localization uncertain
On side opposite lesion:	
Paralysis of face, arm and leg	Corticobulbar and corticospinal tract
Rarely touch, vibration, and position affected	Medial lemniscus
Lateral superior pontine syndrome (syndrome of superior cerebellar artery)	
On side of lesion:	
Ataxia of limbs and gait, falling to side of lesion	Middle and superior cerebellar peduncles, superior surface of cerebellum, dentate nucleus
Dizziness, nausea, vomiting, horizontal nystagmus	Vestibular nucleus
Paresis of conjugate gaze (ipsilateral)	Pontine contralateral gaze
Skew deviation	Uncertain
Miosis, ptosis, decreased sweating over face	Descending sympathetic fibers
On side opposite lesion:	
Impaired pain and thermal sense on face, limbs, trunk	Spinothalamic tract
Impaired touch, vibration, and position sense, more in leg than arm (there is a tendency to incongruity of pain and touch deficits)	Medial lemniscus (lateral portion)

Figure 5. Superior pontine syndrome



Signs and symptoms of occlusion

Paralysis of opposite foot and leg
A lesser degree of opposite arm paresis

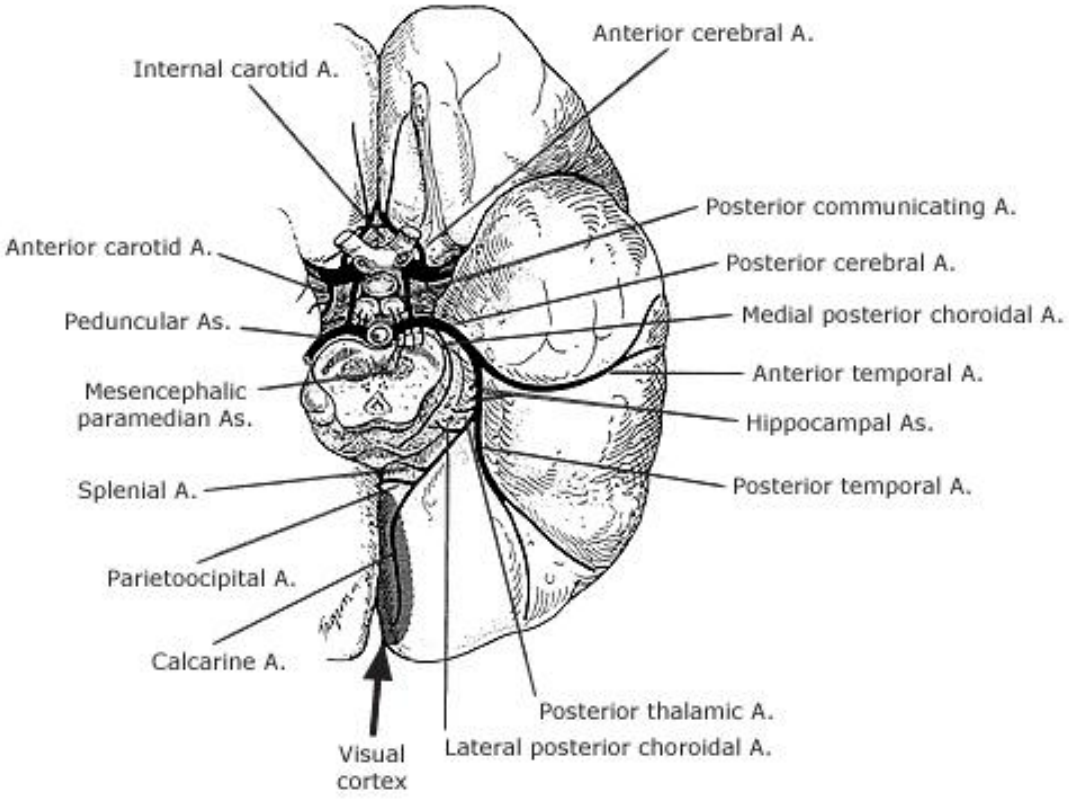
Cortical sensory loss over toes, foot, and leg
Urinary incontinence
Contralateral grasp reflex, sucking reflex, gegenhalten (paratonic rigidity)
Abulia (akinetic mutism), slowness, delay, intermittent interruption, lack of spontaneity, whispering, reflex distraction to sights and sounds
Impairment of gait and stance (gait apraxia)
Dyspraxia of left limbs, tactile aphasia in left limbs

Structures involved

Motor leg area
Involvement of arm cortex or fibers descending to corona radiata
Sensory area for foot and leg
Sensorimotor area in paracentral lobule
Medial surface of the posterior frontal lobe
?Supplemental motor area
Uncertain localization - probably cingulate gyrus and medial inferior portion of frontal, parietal, and temporal lobes

Frontal cortex near leg motor area
Corpus collusum

Figure 6. Anterior cerebral artery distribution and signs and symptoms of occlusion



Signs and symptoms of occlusion	Structures involved
Peripheral territory	
Homonymous hemianopsia (often upper quadrantic)	Calcarine cortex or optic radiation nearby
Bilateral homonymous hemianopsia, cortical blindness, awareness or denial of blindness, tactile naming, achromatopsia (color blindness), failure to see to and fro movements, inability to perceive objects not centrally located, apraxia of ocular movements, inability to count or enumerate objects	Bilateral occipital lobe with possibly parietal lobe
Verbal dyslexia without agraphia, color anomia	Dominant calcarine lesion, posterior corpus callosum
Memory defect	Hippocampal lesion bilaterally or dominant side only
Topographic disorientation and prosopagnosia	Usually nondominant calcarine and lingual gyrus
Simultagnosia, hemivisual neglect	Dominant visual cortex, contralateral hemisphere
Unformed visual hallucinations, peduncular hallucinosis, metamorphopsia, teleopsia, illusory visual spread, distortion of outlines, central photophobia	Calcarine cortex
Complex hallucinations	Usually nondominant hemisphere
Central territory	
Thalamic syndrome: sensory loss (all modalities), spontaneous pain and dysesthesias, choreoathetosis, intention tremor, hand spasm, mild hemiparesis	Posteroventral nucleus of thalamus, involvement of adjacent subthalamus body or its afferent tracts
Thalamoperforate syndrome: crossed cerebellar ataxia with ipsilateral third nerve palsy	Dentatothalamic tract and issuing third nerve
Third nerve palsy and contralateral hemiplegia	Third nerve and cerebral peduncle

Figure 7. Posterior cerebral artery distribution and signs and symptoms of occlusion

Severity of carotid stenosis predicts stroke risk

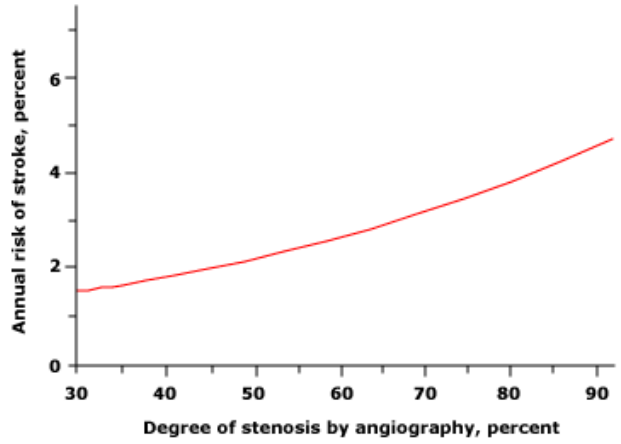


Figure 8. Relation between the degree of carotid artery stenosis and the annual risk of stroke. Data from Barnett, HJ, Eliasziw, M, Meldrum, HE, Taylor, DW, Neurology 1996; 46:603.

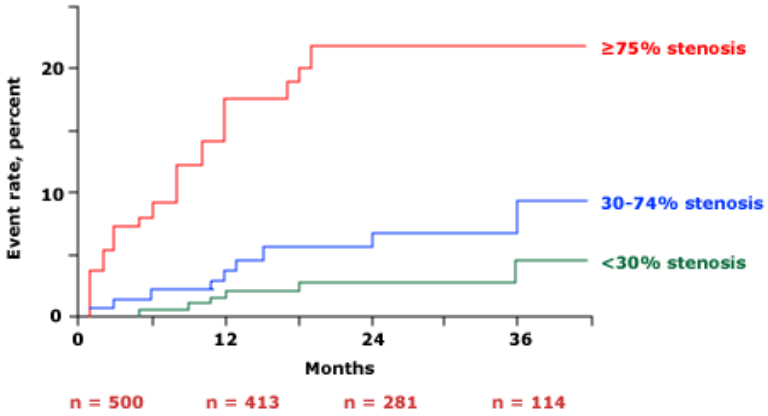


Figure 9. Incidence of ischemic events in 500 patients with asymptomatic carotid artery bruits according to the severity of carotid artery stenosis on initial Doppler ultrasonography. Patients with 75 percent stenosis were at significantly increased risk (P<0.0001). Data from Chambers, BR, Norris, JW, N Engl J Med 1986; 315:860.

Initial evaluation and management of transient ischemic attack and minor stroke

INITIAL EVALUATION — Patients who have had a suspected TIA require urgent evaluation due to the high stroke risk associated with TIA [1]. Furthermore, immediate intervention after a TIA may prevent a significant number of strokes.

The initial evaluation of suspected TIA and minor nondisabling ischemic stroke includes basic laboratory studies that are suggested by the history and physical examination, an electrocardiogram, brain imaging, and neurovascular imaging. Laboratory testing is helpful in ruling out metabolic and hematologic causes of neurologic symptoms, including hypoglycemia, hyponatremia, and thrombocytosis.

Several neurologic disorders give rise to transient focal neurologic symptoms, and these should be considered before establishing a diagnosis of TIA. In addition to TIAs, the most important and frequent causes of discrete self-limited attacks include: Seizures Migraine auras Syncope

Less frequent causes include pressure- or position-related peripheral nerve or nerve root compression that causes transient paresthesias and numbness; peripheral vestibulopathies that cause transient episodic dizziness; and metabolic perturbations such as hypoglycemia and hepatic, renal, and pulmonary encephalopathies that can produce temporary aberrations in behavior and movement.

Hospitalization versus ambulatory evaluation — Whether hospitalization is required for TIA evaluation is not clear, but urgent assessment and management is essential regardless of inpatient or outpatient status [1, 35-39].

Possible advantages of hospitalization include facilitated early use of thrombolytic therapy and other medical management if symptoms recur, expedited TIA evaluation, and expedited institution of secondary prevention [39].

The 2009 American Heart Association and American Stroke Association (AHA/ASA) guidelines for the definition and evaluation of TIA state that it is reasonable to hospitalize

patients with TIA who present within 72 hours of symptom onset and meet any of the following criteria [1] :

- ABCD^2 score (show table 1) of ≥ 3
- ABCD^2 score of 0 to 2 and uncertainty that the diagnostic workup can be completed within two days as an outpatient
- ABCD^2 score of 0 to 2 and other evidence that the event was caused by focal ischemia

The ABCD^2 score (ie, ABCD squared, for Age, Blood pressure, Clinical features, Duration of symptoms, and Diabetes) is a simple prognostic assessment tool with moderate predictive accuracy that was designed to identify patients at high risk of ischemic stroke in the first two days after TIA, as discussed later in detail (table 1).

The 2006 National Stroke Association (NSA) guidelines systematically reviewed, critically evaluated, and updated prior published guidelines for the management of TIA [39]. The following consensus recommendations regarding initial management were proposed, based mainly on evidence from observational studies and clinical experience: Hospitalization should be considered for patients with a first TIA within the past 24 to 48 hours, and is generally recommended for patients with the following conditions:

- Crescendo TIAs
- Duration of symptoms >1 hour
- Symptomatic internal carotid artery stenosis >50 percent
- Known cardiac source of embolus such as atrial fibrillation
- Known hypercoagulable state

- High risk of early stroke after TIA

Patients who need urgent evaluation and are not hospitalized should have rapid access to the following studies:

- Brain imaging with head CT and/or MRI
- Neurovascular studies such as CT angiography (CTA), MR angiography (MRA), and/or ultrasound
- Electrocardiogram (ECG)

All patients with a TIA within the past two weeks who are not hospitalized should undergo investigations within 24 to 48 hours to determine the mechanism of ischemia and subsequent preventive therapy Patients who are not admitted should be informed that they need to return to the hospital immediately if symptoms recur

PROGNOSIS — TIA is a neurologic emergency because patients with TIA and minor stroke are at increased risk of recurrent stroke [40-47]. This risk is illustrated by the following studies:

- A meta-analysis of 11 observational studies published through December 2006 found that the risk of stroke at 2 days, 30 days, and 90 days after TIA was 3.5, 8.0, and 9.2 percent, respectively [45]. In the three studies that used active ascertainment of stroke outcome (ie, face-to-face evaluation by a practitioner at three months rather than use of administrative data), the 2, 30, and 90 day risk of stroke after TIA was even higher (9.9, 13.4, and 17.3 percent, respectively). Similar findings were reported in a meta-analysis of 18 cohorts published through June 2007 [48].

- A prospective observational study of 1380 patients with TIA and 3855 patients with ischemic stroke found that subsequent stroke incidence during the hospital stay was 8 percent for patients with TIA and 7 percent for patients with ischemic stroke [49]. During the first six months after the initial ischemic event, recurrent stroke incidence was 13 percent for both groups. Two percent of patients with TIA died during hospital stay, and 17 percent were dependent at follow-up.
- A well-designed prospective cohort study of 2447 participants from the Dutch TIA trial found that the risk for major vascular events and stroke was highest shortly after TIA or minor stroke, declined to its lowest point at about three years, and then progressively increased over the remainder of the 10-year follow-up (figure 10) [50]. In contrast, the risk for mortality gradually rose throughout the study. By 10 years, 60 percent had died and 54 percent had experienced new vascular events (stroke and myocardial infarction). Event-free survival was 48 percent. Predictive factors for risk of vascular events and death included age over 65 years, diabetes, claudication, previous vascular surgery, and pathologic Q waves on baseline electrocardiogram.

The urgency associated with TIA derives also from the observation that TIAs are most likely to occur in the hours and days immediately preceding ischemic stroke. As an example, a study that analyzed four cohorts of patients who had recent ischemic stroke found that TIAs occurred most often in the 48 hours prior to the stroke [51]. Another study found that the risk of ischemic stroke occurring within 24 hours of a probable or definite TIA was approximately 5 percent [52]. Of all ischemic strokes during the 30

days after a first TIA, 42 percent occurred within the first 24 hours. This may be an overestimate related to the difficulty distinguishing a single ischemic event (stroke) with fluctuating symptoms from separate events (TIA followed by stroke) within a short period of time. Nevertheless, these observations underscore the high early risk of developing a permanent deficit after transient ischemic symptoms and the importance of urgent assessment, risk stratification, and treatment.

Given this short time window and high risk of stroke — 4 to 10 percent in the first 48 hours after TIA [45] — neurologic evaluation of and intervention for TIA should occur urgently. Furthermore, clinical TIAs associated with evidence of infarction by neuroimaging may be a marker of particularly high risk for ischemic stroke.

Recognition and urgent evaluation of TIAs can identify patients who may benefit from preventive therapy or from revascularization of large vessels such as the carotid artery. As examples, premonitory carotid territory TIAs occur in approximately 50 to 75 percent of patients with ischemic stroke from extracranial carotid disease [53-55],and vertebrobasilar TIAs are associated with a risk of subsequent stroke or death that is similar to or possibly higher than that seen with carotid TIAs [56]. In addition, the large artery atherosclerosis subtype of TIA appears to be associated with a higher risk of stroke recurrence at 7 and 90 days after TIA than other subtypes (cardioembolism, small vessel disease, undetermined, or other determined cause) [57].

Predicting stroke risk after TIA — Methods that can reliably assess the risk of stroke after TIA in individual patients would be useful for triaging patients.

Preliminary evidence suggests that a simple assessment called the $ABCD^2$ score (ie, ABCD squared, for Age, Blood pressure, Clinical features, Duration of symptoms, and Diabetes) can be used to identify patients at high risk of ischemic stroke in the first two days after TIA [58]. The $ABCD^2$ score is tallied as follows:

- Age (≥ 60 years = 1 point)
- Blood pressure elevation when first assessed after TIA (systolic ≥ 140 mmHg or diastolic ≥ 90 mmHg = 1 point)
- Clinical features (unilateral weakness = 2 points; isolated speech disturbance = 1 point; other = 0 points)
- Duration of TIA symptoms (≥ 60 minutes = 2 points; 10 to 59 minutes = 1 point; <10 minutes = 0 points)
- Diabetes (present = 1 point)

The $ABCD^2$ score was based upon two earlier prognostic scores for TIA — the California score [43] and the ABCD score [59] — and was derived and validated using independent study populations (two derivation and four validation cohorts) from the US (California) and the UK (Oxford) that included 4809 patients with TIA [58]. The new unified ABCD^2 score was a slightly more accurate predictor of stroke risk than either of its predecessors in these populations.

Estimated two-day stroke risks determined by the $ABCD^2$ score in the combined derivation and validation cohorts were as follows [58] : Score 6 to 7: High two-day stroke risk (8.1 percent) Score 4 to 5: Moderate two-day stroke risk (4.1 percent) Score 0 to 3: Low two-day stroke risk (1.0 percent)

No patient in any of the cohorts with an $ABCD^2$ score of ≤ 1 had a stroke within two days [58]

This study supports the idea that TIA is a high-risk condition and that, in the right clinical context, prognostic scores may identify individuals who are most likely to have an imminent stroke [58].

While the $ABCD^2$ score may be a useful clinical tool, its predictive performance was generally lower in hospital settings (where clinical decisions are resource intensive or involve risk) compared with population based settings, potentially limiting its utility [58]. In addition, there was considerable variation in the stroke risk associated with higher $ABCD^2$ scores among the six population cohorts in which the score was tested. Of concern, a retrospective population-based study found that patients classified as low risk by an $ABCD^2$ score ≤ 4 had a higher rate of stroke (6 percent) within seven days of TIA than low risk patients in the initial report (1 percent) [60]. Twenty-five percent of subsequent stroke events occurred in patients with scores ≤ 4.

Risk models that combine information from acute diffusion-weighted MRI and presumed TIA etiology in addition to the clinical $ABCD^2$ score may improve the accuracy of stroke risk prediction after TIA [61,62]. As an example, the CIP model incorporated diffusion-weighted MRI findings with a dichotomized $ABCD^2$ score [61]. The result was improved accuracy, compared with the $ABCD^2$ score alone, for stroke risk predictions at both two days and seven days after TIA. However, the absence of external validation and the requirement for MRI limit the widespread applicability of this model.

In conclusion, further refinement and validation of stroke risk scores in diverse settings is needed before making clear-cut recommendations based on these scores. Until then, rapid etiologic evaluation and institution of secondary preventive measures are essential for all patients with TIA.

URGENT TREATMENT — The preferred approach to treatment of TIA and ischemic stroke is to determine the pathophysiology of the event so that specific stroke preventive therapy can be prescribed. An overview of the treatment of specific causes of TIA and ischemic stroke is discussed elsewhere. In addition to specific treatment, accumulating evidence suggests that immediate intervention after a TIA or minor ischemic stroke can reduce the risk of recurrent stroke compared with delayed intervention. This point is illustrated by the following reports:

- The prospective EXPRESS study evaluated the impact of expediting outpatient treatment for TIA or minor ischemic stroke [63]. In order to compare traditional with expedited treatment, the study was conducted in two phases. In phase one, 323 patients were seen in a traditional clinic setting where evaluation required a scheduled appointment and treatment recommendations were made to referring physicians. In phase two, 297 patients were seen in an urgent walk-in stroke clinic without having to arrange an appointment, and treatment was implemented immediately by clinic practitioners. In both phases, treatment of confirmed TIA or stroke was individualized according to patient characteristics, but generally included antiplatelet or anticoagulant therapy, statin therapy, antihypertensive medication, and carotid endarterectomy as required.

The following observations were reported [63] :

- The median delay to assessment in the outpatient clinic was significantly reduced from phase one to phase two (3 days versus <1 day), as was the median delay to first prescription of treatment (20 days versus 1 day)

- The risk of recurrent stroke at 90 days was significantly lower for patients seen in phase two than for those seen in phase one (2.1 versus 10.3 percent; adjusted hazard ratio 0.20, 95% CI 0.08-0.49)

Although EXPRESS was not a randomized trial, the study was nested in an ongoing population-based study of stroke and TIA, thus minimizing the potential problems of incomplete ascertainment and selection bias that complicate observational studies.

- The observational SOS-TIA study analyzed the rapid assessment of 1085 patients with suspected TIA in a hospital-based clinic with 24 hour access [64]. Patients were evaluated within four hours of admission, and those with a final diagnosis of confirmed or possible TIA (n = 845) received immediate treatment with a stroke prevention program that included antiplatelet or anticoagulant treatment and/or carotid revascularization as appropriate. At 90 days, the observed stroke rate was much lower than an expected stroke rate predicted by the ABCD^2 scores (1.24 versus 5.96 percent).

The results of this study should be interpreted with caution because of methodologic limitations, including the use of ABCD^2 scores to predict stroke risk, rather than determination of stroke risk in a control population [65].

Early evaluation and intervention for symptomatic carotid artery disease may be an important aspect of stroke prevention. Supporting evidence comes from a pooled analysis of the NASCET and ECST trials, which found that early carotid endarterectomy (within two weeks of a nondisabling stroke or TIA) significantly improved outcome compared with later surgery [66]. Thus, early identification of symptomatic carotid disease is critical.

Given these data, it is recommend that appropriate diagnostic evaluation and stroke prevention treatment be implemented without delay, preferably within one day of the ischemic event, for patients who present with TIA or minor ischemic stroke.

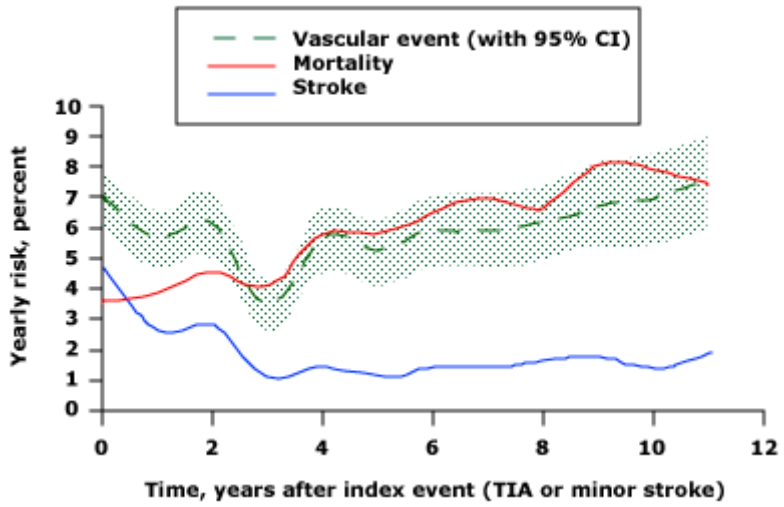


Figure 10. Development of yearly risks over time after TIA or minor stroke. Long-term survival and vascular events risk after transient ischaemic attack or minor ischaemic stroke: a cohort study. Lancet 2005; 365: 2098. Copyright © 2005 Elsevier.

Table 1. ABCD2 score.

The ABCD 2 score can be used to identify patients at high risk of ischemic stroke in the first two days after TIA. The score is tallied as follows:	
Age:	
60 years	1 point
<60 years	0 points
Blood pressure elevation when first assessed after TIA:	
Systolic 140 mmHg or diastolic 90 mmHg	1 point
Systolic <140 mmHg and diastolic <90 mmHg	0 points
Clinical features:	
Unilateral weakness	2 points
Isolated speech disturbance	1 point
Other	0 points
Duration of TIA symptoms:	
60 minutes	2 points
10 to 59 minutes	1 point
<10 minutes	0 points
Diabetes:	
Present	1 point
Absent	0 points

Data from: Johnston, SC, Rothwell, PM, Nguyen-Huynh, MN, et al. Validation and refinement of scores to predict very early stroke risk after transient ischaemic attack. Lancet 2007; 369:283.

Materials and Methods

Methodology

This study was a longitudinal, prospective, observational study.

Sample Size

We prospectively analyzed 249 consecutive patients with TIAs who were referred to our out-patient department within 72 hrs of TIA onset between Oct 2007 and March 2010. Of these, 36 patients were excluded as they did not meet inclusion criteria while 7 patients were excluded because of improper documentation. In effect we could analyze 206 patients. Of these 116 were men and 90 women with a mean age of 54.4 ± 10.1 years. A diagnosis of TIA was made in cases of clinical deficits lasting less than 24 hours regardless of an infarction seen on cerebral imaging scans. ABCD2 scoring of all patients was recorded at the time of their first visit. Computed tomography (CT) was performed on all patients within two weeks of onset of the TIA in order to exclude nonischemic brain lesions such as brain hemorrhage, chronic subdural hematoma, and brain tumors. All patients were followed up for a minimum period of 90 days.

Methods

Inclusion Criteria

Patients referred to Neurology OPD with reversible episodes of neurologic deficits of vascular origin that resolve completely within 24 hours.

Exclusion Criteria

1. Seizures at onset
2. Severe Cognitive impairment
3. Signs and symptoms not consistent with neuroanatomical and vascular distribution

Hospitalization: According to 2006 National Stroke Association (NSA) guidelines, patients with crescendo TIAs, duration of symptoms >1 hour, symptomatic internal carotid artery stenosis >50 percent, known cardiac source of embolus such as atrial fibrillation, known hypercoagulable state, high risk of early stroke after TIA were admitted and these patients received a five day course of subcutaneous heparin in addition to aspirin and statin.

Information on symptoms during the TIAs was obtained from the patients or their families. The presence or absence of the following symptoms was assessed: disturbance of consciousness, speech disturbance, nausea/vomiting, vertigo/dizziness, visual disturbance, motor weakness, sensory disturbance, and gait disturbance. If a patient had a

speech disturbance, a careful history was taken so as to distinguish aphasia from dysarthria.

The following **baseline and clinical characteristics** were evaluated: 1) age and gender: 2) duration of TIA (<1 hour, and 1-24 hours): 3) number of TIAs: 4) use of antiplatelet agents or anticoagulants: 5) past history of brain infarction, TIA, myocardial infarction, or definite angina pectoris: 6) risk factors for stroke, including hypertension, diabetes mellitus, hyperlipidemia, and current smoking: 7) significant arterial pathologies in the carotid system: and 8) potential cardiac source of emboli.

The criteria for **stroke risk factors** were as follows: 1) use of antihypertensive agents, systolic blood pressure (SBP) >160 mm Hg or diastolic blood pressure (DBP) >90 mmHg: 2) use of oral hypoglycemic agents, insulin, or glycosylated hemoglobin (HbA1C) >6.4%: 3) use of antihyperlipidemic agents, or serum cholesterol level >200 mg/dl and serum triglyceride level 150 mg/dL: and 4) current smoking defined as a history of smoking in the preceding three months. Information on risk factors and other comorbidity was obtained primarily from the patient; additional information was collected from relatives. All patients gave in-formed consent and follow-up was by either direct interview or through mobile phone. Patients were directly followed up on 2^{nd}, 7^{th}, 30th, and 90^{th} day.

ABCD2 score (ie, ABCD squared, for Age, Blood pressure, Clinical features, Duration of symptoms, and Diabetes) was used **to identify patients at high risk** of ischemic stroke. The ABCD2 score is tallied as follows:

- Age (≥ 60 years = 1 point)
- Blood pressure elevation when first assessed after TIA (systolic ≥ 140 mmHg or diastolic ≥ 90 mmHg = 1 point)
- Clinical features (unilateral weakness = 2 points; isolated speech disturbance = 1 point; other = 0 points)
- Duration of TIA symptoms (≥ 60 minutes = 2 points; 10 to 59 minutes = 1 point; <10 minutes = 0 points)
- Diabetes (present = 1 point)

For study purpose the patients were **grouped** according to:

1) duration of TIAs into intervals of less than 10 minutes, 10 minutes to less than 2 hours, and 2 hours to less than 24 hours

2) the etiological classification, they were subsequently grouped as Atrial Fibrillation and Non-Atrial Fibrillation groups.

3) the presence or absence of CT findings in patients with no prior history of stroke.

4) treatment, as heparin and non heparin groups

To detect potential cardiac sources of emboli (emboligenic cardiac diseases), all patients underwent 12-lead electrocardiography (ECG) and transthoracic echocardiography. AF included both paroxysmal and persistent AF and was identified during hospitalization. Emboligenic cardiac diseases included non-valvular AF: acute myocardial infarction, old myocardial infarction with intraventricular thrombus: mitral

valve disease: prosthetic cardiac valve: implantation of a pacemaker: and dilated cardiomyopathy.

We performed color-flow duplex ultrasonography in all patients in order to evaluate significant arterial pathologies in the carotid and vertebral system. The grade of stenosis of the internal carotid artery (ICA) was determined by the method used in the North American Symptomatic Carotid Endarterectomy Trial. The lesions were considered significant if the ICA showed >70% stenosis or if an ulceration was evident in the carotid bifurcation.

Ethics

Data for the study was collected following the local ethical guidelines. The identity of the individual patients was completely anonymous. All patients signed an informed consent. There was no delay in any of the therapeutic interventions in order to carry out the present study.

Statistical Analysis

Statistical analysis was performed using PASW version 18.0 statistical software (SPSS Inc, Chicago, Ill). P values <.05 was considered statistically significant.

Results

AGE DISTRIBUTION:

The maximum number of patients were in the age group between 50 and 59 years followed by the age group between 40 and 49, 60 and 69 years. Table 1 shows the age distribution in this study.

TABLE - 1: AGE DISTRIBUTION

Age group in years	***No. of Patients***	***% of Total Patients (206)***
<40	23	11.17
40 – 49	52	25.23
50 – 59	74	35.92
60 – 69	49	23.78
> 70	8	3.9
Total	***206***	***100***

SEX DISTRIBUTION:

There were 116 males (56.3%) and 90 females (43.7%) among the 206 patients in this study.

TABLE 2: SEX DISTRIBUTION IN THIS STUDY

Sex	***No. of Patients***	***% of Total Patients (206)***
Males	116	56.3
Females	90	43.7
Total	***206***	***100***

AGE AND SEX DISTRIBUTION:

Males predominated in the age group between 50 and 59 years followed by 40 to 49 years. Females predominated in the age group between 50 and 59 years followed by 60 to 69 years.

Around two thirds of males (70.7%) were in the age group between 40 and 59 years and two-third of females (61.1%) were in the age group between 50 and 69 years. The Table 3 shows age distribution based on sex.

TABLE 3: AGE DISTRIBUTION BASED ON SEX

Age Group in Years	***Males (116)***	***Females (90)***
<40	13 (11.2%)	10 (11.1%)
40 – 49	31 (26.7%)	21 (23.4%)
50 – 59	41 (35.4%)	33 (36.7%)
60 – 69	27 (23.2%)	22 (24.4%)
> 70	4 (3.5%)	4 (4.4%)
Total	***116 (100%)***	***90 (100%)***

RISK FACTORS

HYPERTENSION:

Among 206 patients, 129 patients had hypertension (62.6%)

TABLE -4: PREVALENCE OF HYPERTENSION IN THIS STUDY

Duration in years	***No. of patients***	***% of total Patients (206)***
Detected now	21	10.2
0 - 1 year	22	10.8
1 - 5 years	43	20.8
> 5 years	43	20.8
Total	***129***	***62.6***

DIABETES:

Out of 206 patients, 92 patients were diabetic (44.6%)

TABLE -5: PREVALENCE OF DIABETES MELLITUS IN THIS STUDY

Duration	***No. of patients***	***% of Total Patients (206)***
Detected now	9	4.36
0 - 1 years	14	6.77
1 - 5 years	29	14.07
> 5 years	40	19.4
Total	***92***	***44.6***

SMOKING:

93 patients were smokers (45.1%), (91 males and 2 females).

TABLE -6: PROPORTION OF SMOKING IN THIS STUDY

Duration	***No. of patients***	***% of Total Patients (206)***
0 - 5 years	7	3.4
5 - 10 years	16	7.8
> 10 years	70	33.9
Total	***93***	***45.1***

ALCOHOLISM:

73 patients were alcoholic (35.4%) (67 were males, 6 were females).

TABLE -7: PREVALENCE OF ALCOHOL INTAKE IN THIS STUDY

Duration	***No. of patients***	***% of Total Patients (206)***
0 - 5 years	5	2.4
5 - 10 years	17	8.25
> 10 years	51	24.75
Total	***73***	***35.4***

SERUM LIPID PROFILE: It was done in all patients.

TOTAL CHOLESTEROL (TC):

TABLE -8: RANGE OF TOTAL CHOLESTEROL VALUES IN THIS STUDY

TC range (mg/dl)	***No. of Patients***	***% of total Patients (206)***
< 150	33	16
150 – 199	89	43.2
200 – 249	44	21.4
> 250	40	19.4
Total	***206***	***100***

Above cut off in 40%

TRIGLYCERIDES:

TABLE - 9: RANGE OF TRIGLYCERIDES VALUES IN THIS STUDY

TGL range	***No. of Patients***	***% of total Patients (206)***
< 150	29	14.02
150 – 199	75	36.5
200 – 399	101	49
> 400	1	0.48
Total	***206***	***100***

HDL CHOLESTEROL:

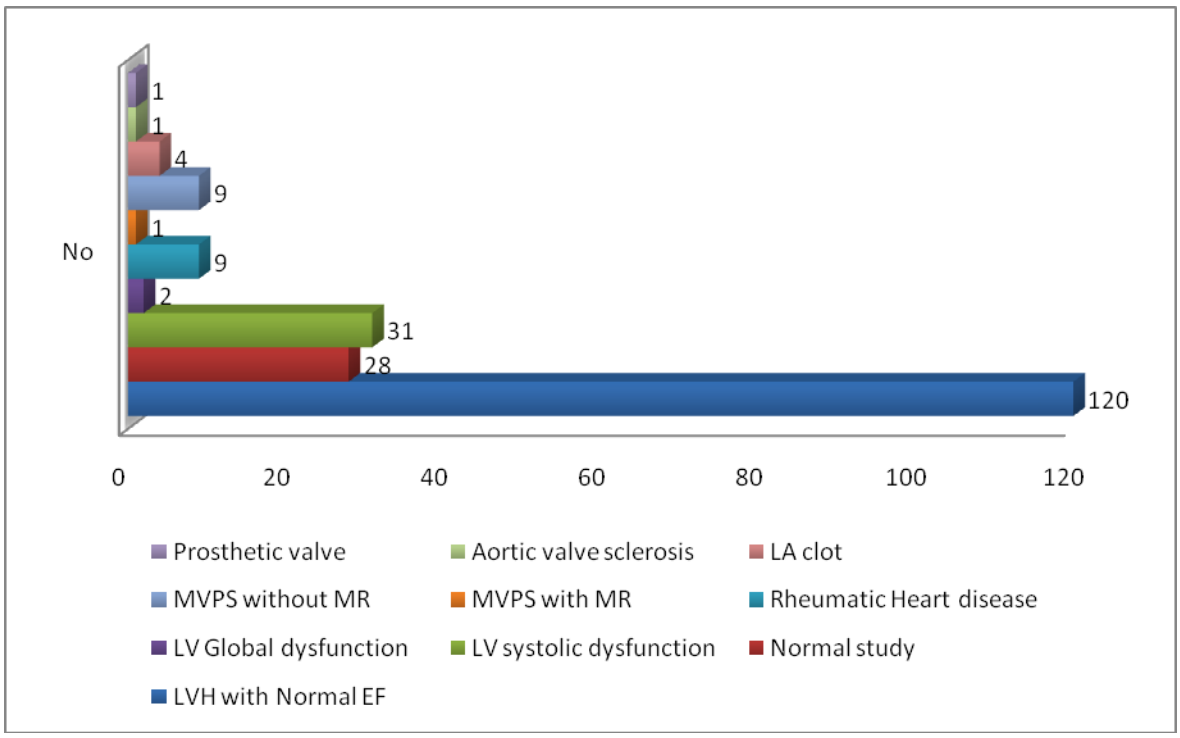
TABLE -10: RANGE OF HDL CHOLESTEROL VALUES IN THIS STUDY

HDL range (mg/dl)	***No. of Patients***	***% of total Patients (206)***
> 40	84	40.77
< 40	122	59.23
Total	***206***	***100***

ECHO CARDIOGRAPHY:

It was done in all patients (206) **(Table: 11)**

Echo	***No***	***% of total Patients (206)***
LVH with Normal EF	120	58.4
Normal study	28	13.6
LV systolic dysfunction	31	15
LV Global dysfunction	2	0.96
Rheumatic Heart disease	9	4.3
MVPS with MR	1	0.48
MVPS without MR	9	4.3
LA clot	4	1.9
Aortic valve sclerosis	1	0.48
Prosthetic valve	1	0.48
Total	***206***	***100***



CLINICAL FEATURES:

The clinical features of all the patients were studied in detail. The commonest presentation was the weakness of the extremities with or without speech, language, sensory and gait disturbances.

MOTOR WEAKNESS:

It was the commonest clinical presentation and seen in 135 patients among the 206 patients (65.53%) in this study. Among the 135 patients, Right side weakness was found in 53 patients (25.72%) and Left side weakness was seen in 82 patients (39.81%).

TABLE - 12: DISTRIBUTION OF WEAKNESS

Side of weakness	***No. of Patients***	***% of total Patients (206)***
Right	53	25.72
Left	82	39.81
Total	***135***	***65.53***

In addition, facio brachial monoparesis was seen in 15 patients, of which 13 were right sided and 2 were left sided.

APHASIA:

Aphasia was seen in 33 patients among the 206 patients (16.2%). Of these 33 patients, 21 patients (66.6%) had right side weakness and 3 patients (9.1%) had left side weakness. Aphasia as the only clinical manifestation was seen in 4 patients while 5 patients had other symptoms in addition to aphasia

DYSARTHRIA:

Among the 206 patients in this study, 51 patients had dysarthria.

TABLE -14: DISTRIBUTION OF DYSARTHRIA

	No. of Patients	***% of total Patients (206)***
Anterior Circulation	26	12.6
Post Circulation	25	12.1
Total	***51***	***24.7***

SENSORY DISTURBANCE:

It was seen in 30 patients out of the 206 patients (14.56%). Table 14 shows the distribution of sensory disturbance in this study. Sensory disturbance as the only symptom occurred in 2 patients.

TABLE -15: DISTRIBUTION OF SENSORY DISTURBANCE

Side of sensory disturbance	***No. of Patients***	***% of total Patients (206)***
Right side	14	6.8
Left side	16	7.76
Total	***30***	***14.56***

OTHER CLINICAL FEATURES:

TABLE -15: DISTRIBUTION OF OTHER CLINICAL FEATURES

S.No	***Clinical features***	***No. of Patients***	***% of total Patients (206)***
1.	Visual Disturbance	17	8.25
2.	Nausea & Vomiting	18	8.7
3.	Dizziness/Vertigo	25	12.1
4.	Gait Disturbance	48	23.3
5.	LOC	38	18.4
6.	Headache	6	2.9
7.	TIA in the past	67	28
8.	Stroke in the past	43	20.8

TERRITORIAL DISTRIBUTION: TABLE – 16

135 out of 206 (55.82%) patient had symptoms related to carotid territory while 63 (30.58%) had symptoms of vertebrobasilar territory. 8 patients (3.38%) had mixed symptoms. While territory was uncertain in 20 (9.72%)

Territory	***No. of patients***	***% of total Patients (206)***
Carotid	115	55.82
Vertebrobasilar	63	30.58
Mixed	8	3.88
Uncertain	20	9.72
Total	***206***	***100***

DURATION OF SYMPTOM:

The symptom duration was reported as follows: <10 minutes in 64 patients, ≥ 10 and <30 minutes in 21, ≥ 30 and <60 minutes in 17, ≥ 1 and < 2 hours in 31, ≥ 2 and < 12 h 30 in 30, and ≥ 12 hours in the remaining 43 patients. In effect 64 patients had symptoms lasting < 10 min, 38 had symptoms between 10 and <60 minutes while 104 patients had symptoms lasting > 60 minutes. There was no significant difference between short duration (< 60 min, 102 patients) and long duration (> 60 min, 104 patients) TIAs in terms of the proportion. For this study we classified the patients into three groups for further analysis: 64 patients with TIAs <10 minutes (Group 1); 69 patients with TIAs ≥10 minutes and < 2 hours (Group 2); and 31 patients with TIAs ≥ 2 hours (Group 3).

DEMOGRAPHIC CHARACTERISTICS, COMORBIDITY, AND RISK FACTORS WITH RESPECT TO DURATION OF SYMPTOM: TABLE - 17

	Group 1 <10 min (n=64)	***Group 2 >10 min to <2 h (n=69)***	***Group 3 2 h to <24 h (n=73)***	***Total (n=206)***	***P value***
Age, Years	57.2	58.1	58.7	58	0.521
Sex, M %	56.25 (36)	53.6 (39)	56.1 (41)	55.1 (116)	0.993
Prior TIA	36 (23)	21.8 (15)	26 (19)	28 (67)	0.002
Prior stroke	9.3 (6)	20.2 (14)	31.5 (23)	20.8 (43)	0.0153
Atrial fibrillation	4.6 (3)	8.7 (6)	20.5(15)	11.7 (24)	0.039
Arterial hypertension	64 (41)	60.8 (42)	63 (46)	62.6 (129)	0.86
Hypercholesterolemia	43.6 (28)	37.2 (26)	39.5 (30)	40.7 (84)	0.653
Diabetes mellitus	43.7 (28)	47.8 (33)	42.4 (31)	44 (92)	0.895
Smoking	43.7 (28)	46.3 (32)	46.5 (34)	45.1 (93)	0.788
Cardiac Disease	20.3 (13)	24.6 (17)	21.9 (16)	22.3 (46)	0.68
Arterial disease	6.2 (4)	5.7 (4)	6.8 (5)	6.3 (13)	0.986

 All values in percentage. Values in bracket are absolute numbers.

A history of cerebral infarction, atrial fibrillation was found more frequently in Groups 2 and 3 than it was in Group 1. While history of prior TIA was more frequent in Group 1. No other differences in history or risk factors were observed among the three groups (table 16).

DEMOGRAPHIC CHARACTERISTICS, COMORBIDITY, AND RISK FACTORS WITH RESPECT TO ETIOLOGY: TABLE - 18

	AF Group (n=24)	***Non-AF Group (n=182)***	***P Value***
Age, years	59.7	56.3	0.015
Sex, M (%)	56.2	54.4	0.834
TIA Duration <1 hours 1 to 24 hours	 12 12	 90 92	0.971
Number of TIAs 1 2 to 3 4 to 9	 20 4 0	 116 40 26	0.267
Medication at TIA, Antiplatelet Anticoagulation	 4 4	 44 4	0.538
Past History TIA Brain Infarction Angina Myocardial Infarction	 8 8 0 0	 59 69 13 9	0.419
Risk Factor Arterial hypertension Hypercholesterolemia Diabetes mellitus Smoking	 12 6 4 12	 117 78 88 79	0.32
Arterial Disease	4	86	0.032
Embologenic Cardiac Diseases other than AF RHD, MVP others	 0	 24	0.078

Twenty four patients had AF (the AF group) and 182 did not have AF (non-AF group). Table 1 shows the clinical characteristics of these two groups. The mean of age in the AF group was higher than in the non-AF group (p=0.015). No significant differences between the two groups were observed in the duration or number of TIAs, use of medication, past history, or risk factors. Arterial diseases were seen more frequently in the non-AF group than in the AF group 53% vs 17%, (p=0.028). Emboligenic cardiac diseases were observed in 48 (23%) patients: 24 patients had non-valvular AF, 9 had rheumatic heart disease, 10 had MVPS, 1had a prosthetic mitral valve, 1 had aortic valve sclerosis. Other than AF, there were no significant differences observed in emboligenic cardiac diseases between the two groups (Table 17).

CLINICAL TIA SYMPTOMS OF THE 2 GROUPS: TABLE 19

	AF Group (n=24)	***Non-AF Group (n=182)***	***P Value***
Consciousness disturbance (%)	25 (6)	17.5 (32)	0.008
Speech disturbance (%)	50 (12)	42.8 (72)	0
Nausea/vomiting (%)	4.1 (1)	9.3 (17)	0.032
Dizziness/vertigo (%)	8.3 (2)	12.6 (23)	0.022
Visual disturbance (%)	8.3 (2)	8.2 (15)	0
Motor weakness (%)	66.6 (18)	64.2 (117)	0.47
Sensory disturbance (%)	12.5 (3)	14.8 (27)	0.18
Gait disturbance (%)	29.1 (7)	22.5 (41)	0.042

 All values in percentage. Values in bracket are absolute numbers.

Consciousness disturbance (25% vs 17.5%; P = 0.008) and gait disturbance (29.1% vs 22.5%; P =.042) were more frequent in the AF group than in the non-AF group, whereas nausea/vomiting (4.1% vs 9.3%; P = 0.032) and dizziness/vertigo (8.3% vs 12.6%; P =.022) were more frequent in the non-AF group than in the AF group. No differences in speech disturbance (50% vs 42.8%; P = 0), visual disturbance (8.3% vs 8.2%; P = 0), motor weakness (66.6% vs 64.2%; P = 0.47), and sensory disturbance (12.5% vs 14.8%; P = 0.18) were identified between the 2 groups.

RECURRENT TIA

The proportion of patients with recurrent TIA was 34% (70 out of 206 patients) in our study. 44 patients (21.4%) had 2 to 3 TIAs while 26 patients (12.6%) had > 4 TIAs. Of the recurrent TIAs 22 patients had stereotypical symptoms and most of them were of < 30 min. of the 48 patients with non –stereotypical TIAs, 32 had symptoms relating to vertebrobasilar territory.

TRANSIENT SYMPTOMS WITH INFARCTION

Of the 206 patient a total of 162 had TIA without prior history of stroke. 36 (22.2%) patients in this group had brain CT showing infarction.

DEMOGRAPHIC CHARACTERISTICS, COMORBIDITY, AND RISK FACTORS WITH RESPECT TO BRAIN CT: TABLE – 20

	Sample Size	***CT showing Lesion (n=36)***	***P Value***
Age			
<60	94	25.5 (14)	0.02
>60	68	32.3 (22)	
Sex			
Male	92	27.1 (25)	0.125
Female	70	15.7 (11)	
Prior TIA			
Yes	58	18.9 (11)	0.511
No	104	24 (25)	
Arterial hypertension			
Yes	78	32 (25)	0.0105
No	84	13.1 (11)	
Diabetes mellitus			
Yes	71	21.1 (15)	0.79
No	91	23.1 (21)	
Smoking			
Yes	63	25.3 (16)	0.494
No	99	20.2 (20)	
Prior Cardiovascular Disease			
Yes	36	22.2 (8)	1
No	126	22.2 (28)	
TIA Location			
Anterior	103	23.3 (24)	0.853
Posterior	51	21.5(11)	
Both	8	12.5 (1)	
Stenosis			
Yes	68	30.8 (21)	0.0467
No	94	16 (15)	
Symptom duration			
<1hr	56	17.8 (10)	0.392
>1 hr	106	24.5 (26)	

Of the 162 patients, 36 (22.2%) revealed cerebral infarctions, all of which were supratentorial. Infarcts were found in 25 men and 11 women. Small deep infarcts (basal ganglia and internal capsule, but none in the thalamus) were found in 12 patients, while 19 had cortical or subcortical infarcts and 5 had multiple infarcts (4 with vertebrobasilar TIAs). Twenty-four carotid TIA patients had a cerebral infarct. In 17 of these the lesion was ipsilateral to the symptomatic hemisphere (although in 3 the symptoms did not correspond to the site of the infarct), while in 6 the lesion was contralateral and 1 patient had bilateral multiple infarcts. Eleven vertebrobasilar patients had infarcts. In 4, the infarct was in the posterior cerebral artery distribution causing visual disturbance. None of the other 7 vertebrobasilar TIA patients with infarcts had lesions correlated with the TIA. One patients with mixed TIAs had infarcts; and the lesion corresponded to the symptomatic carotid territory. Thus, of all 162 patients, 23 (14.1%) had an infarction relating to the TIA symptoms and 15 had asymptomatic, silent infarcts. (Two patients had both symptomatic and asymptomatic infarcts.) Age more than 60 and presence of stenosis were significantly associated with infarct on CT. There was no significant difference in the frequency of infarction shown by CT, however, between carotid and vertebrobasilar patients ($P = 0.853$), nor any significant associations between cerebral infarction and gender, prior TIA, hypertension, diabetes mellitus, cardiac disease, or a past history of smoking. There was no significant association between duration of symptom and presence of infarction.

ABCD2 SCORE: TABLE – 21

ABCD2 Score	***Patients (%)***
<1	2 (1%)
2	28 (13.5%)
3	32 (15.5%)
4	42 (20.5%)
5	42 (20.5%)
6	30 (14.5%)
7	30 (14.5%)
Total	***206 (100%)***

GROUPING ACCORDING TO RISK: TABLE - 22

ABCD2 Score	***No. of Patients***	***% of total Patients (206)***
0 - 3	62	30.1
4 – 5	84	40.8
6 – 7	60	29.1
Total	***206***	***100***

62 (30.1%) patients were in low risk group, 84 (40.8%) in moderate risk, while 60 (29.1%) were in high risk group

ABCD2 SCORE AND THE RISK OF DEVELOPING STROKE AT 2, 7, 30 AND 90 DAYS

TABLE - 23

ABCD2 Score	***Patients (%)***	***Stroke in 2 days***	***% Risk (95% CI)***
<1	2 (1%)	0	0
2	28 (13.5%)	0	0
3	32 (15.5%)	0	0
4	42 (20.5%)	1	2.4% (0 -6.99)
5	42 (20.5%)	3	7.1% (0 – 14.93)
6	30 (14.5%)	3	10% (0 – 20.74)
7	30 (14.5%)	4	13% (1.17 – 25.49)
Total	***206 (100%)***	***11 (100%)***	***5.3% (2.27 – 8.41)***

TABLE - 24

ABCD2 Score	***Patients***	***Stroke in 7 days***	***% Risk (95% CI)***
<1	2 (1%)	0	0
2	28 (13.5%)	0	0
3	32 (15.5%)	0	0
4	42 (20.5%)	1	2.4% (0 -6.99)
5	42 (20.5%)	4	9.5% (0.64 – 18.4)
6	30 (14.5%)	6	20% (5.69 – 34.31)
7	30 (14.5%)	9	30% (13.6 – 46.4)
Total	***206 (100%)***	***19 (100%)***	***9.2% (5.27 – 13.17)***

TABLE - 25

ABCD2 Score	***Patients***	***Stroke in 30 days***	***% Risk (95% CI)***
<1	2 (1%)	0	0
2	28 (13.5%)	0	0
3	32 (15.5%)	0	0
4	42 (20.5%)	1	2.4% (0 -6.99)
5	42 (20.5%)	4	9.5% (0.64 – 18.4)
6	30 (14.5%)	6	20% (5.69 – 34.31)
7	30 (14.5%)	9	30% (13.6 – 46.4)
Total	***206 (100%)***	***19 (100%)***	***9.2% (5.27 – 13.17)***

TABLE - 26

ABCD2 Score	***Patients***	***Stroke in 90 days***	***% Risk (95% CI)***
<1	2 (1%)	0	0
2	28 (13.5%)	0	0
3	32 (15.5%)	0	0
4	42 (20.5%)	1	2.4% (0 -6.99)
5	42 (20.5%)	6	14.2% (3.71 – 24.87)
6	30 (14.5%)	6	20% (5.69 – 34.31)
7	30 (14.5%)	11	36.6% (19.43 – 53.91)
Total	***206 (100%)***	***24 (100%)***	***11.6% (7.27 – 16.03)***

A total of 24 patients developed stoke within 3 months. The 90 day risk of developing stroke was 11.6%. 11 of these occurred in first 2 days. The risk was highest in patients with score of 7. The risk being 13%, 30% and 36.6% at 2, 30 and 90 days respectively. There was no difference between the 7th day and 30th day risk. Patients with score between 0 and 3 did not develop stoke within 90 days. There was no mortality within 90 days.

TREATMENT OUTCOME AFTER 7 DAYS: TABLE - 27

Out of 38 patients who received heparin, 5 (13.2%) developed stroke within 7 days while 14 patients (8.3%) in non heparin group developed stroke. Although the proportion of patients in heparin group was higher, it was not statistically significant

	Total	***Stroke***	***No Stroke***	***p value***
Heparin group	38	5 (13.2%)	33 (86.8%)	0.527
Non Heparin group	168	14 (8.3%)	154 (91.7%)	
Total	***206***	***19 (9.2)***	***186 (90.8)***	

DISCUSSION

AGE: The maximum number of patients were in the age group between 50 and 59 years followed by the age group between 40 and 49, 60 and 69 years. The mean age of studied population was 54.4 ± 10.1 years.

K. E. Murros et al in 1989 reported the mean age in his study population as 67.4 years[67]. Christian W et al., in 2002 reported the mean age of TIA in German population as 66.4 years [68].

Kimura et al in his study reported the mean age of 65.7±10.3 years from Osaka, Japan[69] While Takeshi I et al in his 2004 study of 1084 patients gives the mean age as 70.8 years[70]. The maximum patients were in age group of 65 to 74 years and 75 to 84 years. 34.5% were in 65 to 74 years group while 24.3% were in the 65 to 74 year group. Nearly 10% were above 85 years.

The mean age in our study was one decade earlier compared to the above studies. This could be due to the fact that Indian population develop stroke one to two decades earlier than that of the Western population, because of early atherosclerosis and increasing number of young hypertension and diabetes patients. This may also be a reflection of the demographic profile of the population being studied.

SEX: There were 116 males (56.3%) and 90 females (43.7%) among the 206 patients in this study showing a general male preponderance. This is in keeping with what has been reported earlier.[19-21]

AGE DISTRIBUTION BASED ON SEX:

Age distribution based on the sex in our study showed that among the males, 70.7% of cases were in the age group between 40 and 59 years. But 61.1% females were in the age group between 50 and 69 years. The mean age in our study was 52.4 $\pm$ 10.2 for men, 56.6 $\pm$ 10.6 for women. More number of females developed TIA at a later age compared to males.

HYPERTENSION:

Arterial hypertension is defined as systolic BP greater than 140 mm. Hg. or diastolic BP greater than 90 mm Hg. It is one of the most important and effective modifiable risk factors. But unfortunately it remains untreated or under treated (Hajjar and Kotchen, 2003) [71]. It predisposes to ischemic stroke by aggravating atherosclerosis and increases the relative risk for stroke three to four fold. Blood pressure treatment, resulting in modest reduction in SBP of 10 to 12 mm Hg. and 5 to 6 mm Hg. Diastolic BP is associated with a 38% reduction in stroke incidence. (MacMohan and Rodgers, 1996) [72].

In our study, hypertension was present in 62.6% of patients and around 33.3% of these patients had hypertension of more than five years duration.

According to Lausanne stroke registry, hypertension was seen in 45.5% of patients [73]. Takeshi Inoue et al in 2004 reported that nearly 53% of patients with TIA had hypertension. Ricci S et al from the SEPIVAC study reported a prevalence of 43.6% [74].

The increased incidence of hypertension in our study could be due to general increase in HT population in Southeast Asia.

According to Trivandrum Stroke Registry, hypertension was seen in 80% of stroke patients, which was slightly higher than our study [75]

From German Stroke Data Bank, Christian Weimar et al in 2002 reported a prevalence of 62.9% in TIA patients [68]. This is similar to what was seen in our study.

DIABETES MELLITUS:

DM is associated with stoke, independently of the various cardiovascular risk factors which usually accompany this disease. Indeed, the relative risk of stroke of all ages was 1.8 for diabetic men and 3.0 for diabetic women (Shinton and Beever, 1989, Burchfield et al 1994) [76,77].

In our study, diabetes mellitus was found in 44.6% of patients. 43% of these patients had diabetes of more than five years duration. 10% of these patients were diagnosed to have DM during this present admission, after having ruled out the possibility of stress induced hyperglycemia with the help of HbA1C and follow up blood glucose testing after one week to ten days.

Barcelona stroke registry documented 21% of patients with diabetes among the ischemic strokes. [78]

Kazumi Kumra et al reported 24% of diabetes among TIA patient. While Takeshi I et al reported a low of 16%. Christian Weimar et al reported that 21.6% had diabetes [68]. 14.9% had diabetes in SEPIVAC study from Italy [74].

The increase in diabetic population in our study reflected the general increase in the incidence of diabetes in the Southeast Asia.

SMOKING:

It raises the blood fibrinogen, enhances platelet aggregation and increases the hematocrit level and blood viscosity. Smoking cessation substantially decreases the risk for subsequent stroke. The incidence of stroke is 50% higher in smokers.

Our study showed that 93 patients out of total 206 patients (45.1%) were found to be smokers currently. 76% of these patients were smokers of more than 10 years duration. Among these 93 patients, 91 were males and 2 were females.

Kazumi Kumra et al reported that nearly 50% of TIA patient had a history of smoking [69]. While 18.5% were smokers in Takeshi I et al report [70]. 24.1% of TIA patients were smokers in German Stroke Data Bank (Christian Weimar et al) [68] and 28.7% were smokers in Ricci S et al study [74]. So the prevalence varies widely among the various population studied.

ALCOHOLISM:

Chronic heavy alcohol consumption and binge drinking may exert their harmful effects through changes in Blood Pressure, platelet aggregability, blood coagulation and the level of triglycerides.

In this study, 73 patients were alcoholic (35.4%) among the total 206 patients. Of these 73 patients, 67 were males and 6 were females. Around 70% of these patients were alcoholic for more than 10 years duration.

DYSLIPEDEMIA:

84 patients out of 206 in our study had hypercholesterolemia (40.7%). And nearly 85% had serum triglyceride levels > 150 mg/dL. While Takeshi Inoue et al reported a prevalence of 18% [70]. Data from German Stroke Data Bank give a figure of 40.1% [68]. This is in keeping with what is seen in our report. Dyslipidemia esp hypertriglyceridemia seems to be more prevalent in Indian population compared to the western population. This could be because of the genetic makeup as well as the higher prevalence of diabetes among Indian population.

PRIOR TIA:

History of prior TIA was seen in 67 patients (28%). This is same as what has been reported by Christian Weimar et al from German Stroke Data Bank analysis [68]. While Kimura et al in his study reported a much lower proportion of 18% [69].

PRIOR STROKE:

43 out of 206 patients (20.8%) had a history of stroke in the past in our study. This is almost similar to the report from Germany by Christian Weimar et al of 21.2% [68]. and from Japan by Kimura et al who reported 23% [69].

ATRIAL FIBRILLATION: Atrial Fibrillation was seen in 24 patients out of 206 (11.7%). This is almost similar to what was reported by Weimar C, Kraywinkel K, Rodl J, et al; German Stroke Data Bank Collaborators (11%) [68]. Johnston SC et al reported that 9% of 1707 TIA patients (mean age, 72 years) in 16 hospitals in northern California had AF [58]. Ricci S et al study in 1991 reported 9.6% of TIA patients had AF [74]. While higher values of 15% and 18% were reported by Kimura et al and Takeshi I et al in

their studies respectively [69,70]. Japanese are reported to be at lower risk for atherosclerosis of the extracranial carotid artery than Caucasians.16 Therefore, the proportion of TIA patients with AF may be relatively higher in Japanese than in Caucasians and South Asians.

CLINICAL FEATURES

WEAKNESS

Motor weakness was the commonest clinical presentation and was seen in 65.53% in this study. Among the 135 patients, Right side weakness was found in 53 patients (25.72%) and Left side weakness was seen in 82 patients (39.81%).

SPEECH DISTURBANCE

Speech disturbance was the next common symptom seen in 40.77% (aphasia constituted 16.2% and dysarthria 24.57%). Aphasia was seen in 33 patients among the 206 patients (16.2%). Of these 33 patients, 21 patients (66.6%) had right side weakness and 3 patients (9.1%) had left side weakness. Aphasia as the only clinical manifestation was seen in 4 patients while 5 patients had other symptoms in addition to aphasia

SENSORY DISTURBANCE

It was seen in 30 patients out of the 206 patients (14.56%). Sensory disturbance as the only symptom occurred in 2 patients.

OTHER SYMPTOMS

Gait disturbance, loss of consciousness, dizziness/vertigo, nausea/vomiting, visual disturbance were other commonly reported symptoms. Headache during presentation was seen in only 6 patients. Other rare symptom like limb shaking TIA was seen in 1.

TERRITORIAL DISTRIBUTION

115 out of 206 (55.82%) patient has symptoms related to carotid territory while 63 (30.58%) had symptoms of vertebrobasilar territory. 8 patients (3.38%) had mixed symptoms while in 20 patients it was uncertain. This is similar to what has been reported in Rochester [79], and Tartu studies [80] and by C Fieschi, F Mariani et al from Italian multicenter study of reversible cerebral ischemic attacks in 1983 [81]. Fratiglioni and Arfaioli et al in 1989 reported more of vertebrobasilar TIAs (VB 48.8% and CA 23.3%) [82].

DURATION OF SYMPTOM:

There was no significant difference between the proportion of patients with short duration (< 60 min, 102 patients) and long duration (> 60 min, 104 patients) TIAs in our study. Although epidemiological studies to date have not investigated the duration of symptoms in TIAs, other hospital-based studies have reported a mean duration of 207 minutes and symptoms lasting more than 30 minutes in 50% of all patients with TIAs.

An analysis from the German Stroke Data Bank by Christian Weimar et al has shown a high prevalence of long-duration TIAs (70%) [68].

CLINICAL CHARECTERISTICS IN TIA PATIENTS WITH ATRIAL FIBRILLATION

Our study showed an association between AF and 5 clinical features: (1) age ≥ 60 years, (2) disturbance of consciousness, (3) nausea and vomiting, (4) dizziness/vertigo and (5) gait disturbance during TIA.

Consciousness disturbance was more frequent in AF group than in non-AF group. This finding is similar to what has been reported by Takeshi Inoue and Kazumi Kimura in their study [69,70]. They hypothesized that Emboli originating from the left atrium may be larger than those originating from ulcerated arterial atheroma. Transient embolic occlusion of a larger artery may have occurred in TIA patients with AF and not in those without AF. Conversely, microemboli from carotid disease can travel easily through the large cerebral arteries and lodge in the small artery, resulting in mild neurologic deficits.

Takeshi Inoue and Kazumi Kimura et al also noted in their study that AF patients had more speech disturbance compared to non-AF group [69,70]. This was not seen in our study. Nausea/vomiting and dizziness/vertigo were more frequent in the non-AF group than in the AF group while gait disturbance was more common in AF group.

TRANSIENT SYMPTOMS WITH INFARCTION

The awareness that a classically defined TIA (<24 hours in duration) can be associated with irreversible ischemic brain injury led to a proposal to label these events as "transient symptoms associated with infarction" (TSI) or "cerebral infarction with transient signs (CITS)" and to distinguish them from transient symptoms without infarction by Ay H; Koroshetz WJ et al in 2005 [4].

While TSI in general has smaller infarct volumes than classically defined ischemic stroke (where neurologic deficits persist for ≥ 24 hours), there is no unique size that differentiates TSI from ischemic stroke [4] .

Patients with TSI have a higher short-term risk of recurrent ischemic stroke than patients who have transient symptoms without infarction. This conclusion is supported by a number of head CT and DWI studies [4-8]

The reported prevalence of cerebral infarction in TIA patients has varied considerably. In 1976, Kinkel and Jacobs [83] re-ported no CT abnormalities in 32 patients. However, most subsequent studies have reported frequencies ranging from 20% to 40% [84-86]. The 22.2% prevalence in our sample is in confirmation with this view.

RELATIONSHIP OF SYMPTOM DURATION AND INFARCTION:

Bogousslavsky and Regli in 1985 [84] found that the mean duration of the TIAs without infarct was significantly shorter (21min) than that of the TSI (358 min). But Calandre et al. in their 1984 report [85] did not show any relationship between the duration of symptom and the frequency of abnormal CT scans.

Recently some reports using DWI suggest that increased duration of classically defined TIA (<24 hours in duration) is associated with a higher probability of infarction, but the association is not absolute [4, 9-12]. A systematic analysis of patients with classically defined TIA found that symptom duration was not a reliable predictor for the presence of infarction, even though the mean duration tended to be significantly longer in patients with infarction than in those without infarction.

In our study there was no significant difference in duration of TIA between the two groups.

Analysis of associations among risk factors and CT infarcts shows that Carotid stenosis greater than 50%, hypertension and older age each significantly increased the

incidence of cerebral infarctions in our study. This is similar to what has been shown by K. E. Murros and G.W. Evans in 1989 [67].

Awad et al. [87] reported a slightly higher incidence of cerebral infarction in vertebrobasilar patients than in carotid patients, while Berguer et al. [88] reported a significantly greater incidence of infarction in patients with carotid TIAs. In our scans, infarction prevalence was slightly higher in carotid than vertebrobasilar patients (23.3% and 21.5%) but it was not statistically significant.

Although we did not look at the interval between the date of TIA and the appearance of CT finding, previous reports have failed to see any significant association between the two.

ABCD^2 SCORE AND THE RISK OF DEVELOPING STROKE AT 2, 7, 30 AND 90 DAYS

The California score and the ABCD score both reliably predicted short-term risk of stroke after presentation with TIA. Johnston et al in 2007 and others subsequently have validated that the unified scoring system of ABCD^2 has better predictive value compared to the either scoring system alone [58,60]. This score predicts the 2 day risk better than the other scores. They also stratified patients in to three groups according to the score: (1) Score 6 to 7: High two-day stroke risk (8.1 percent), (2) Score 4 to 5: Moderate two-day stroke risk (4.1 percent), (3) Score 0 to 3: Low two-day stroke risk (1.0 percent). In our study 62 (30.1%) patients were in low risk group, 84 (40.8%) in moderate risk, while 60 (29.1%) were in high risk group. While the overall risk stratification was similar to the study from Johnston et al, there were higher number of patients with a score of 7 (14.5%)

in our study compared to the study from Johnston et al (4.2%) [58]. This may be because of larger proportion of patients with diabetes and hypertension in our study population.

A total of 24 patients developed stoke within 3 months in our study. The 90 day risk of developing stroke was 11.6%. Almost half of them (11 strokes) occurred in first 2 days. This is similar to what has been previously reported by Johnston et al (50%) [58]. The risk was highest in patients with score of 7. The risk being 13%, 30% and 36.6% at 2, 7 and 90 days respectively.

The overall risk of developing stroke at 2^{nd}, 30^{th} and 90^{th} day were 5.3%, 9.2% and 11.6% respectively in our study. This is similar to a meta-analysis of 11 observational studies published through December 2006 were the risk of stroke at 2 days, 30 days, and 90 days after TIA was 3.5, 8.0, and 9.2 percent, respectively [45] . In the three studies that used active ascertainment of stroke outcome (ie, face-to-face evaluation by a practitioner at three months rather than use of administrative data), the 2, 30, and 90 day risk of stroke after TIA was even higher (9.9, 13.4, and 17.3 percent, respectively). Similar findings were reported in a meta-analysis of 18 cohorts published through June 2007 [48]

Patients with score between 0 and 3 did not develop stoke within 90 days. There was no mortality within 90 days in our study while other studies have shown differently. A large hospital-based study in San Francisco, Calif, reported a mortality rate of 2.6% within the first 90 days, of which 44% of deaths were due to a new stroke. German Stroke Data Bank analysis study reported a lower percentage of 1.7% [68]. This discrepancy may be because of the smaller number of patients analyzed in our study.

TREATMENT OUTCOME AFTER 7 DAYS

Since the maximum stroke risk is within 7 days, it is important that these patients are quickly evaluated and appropriately treated at the earliest. Appropriate treatment depends upon the pathophysiological mechanism behind the ischemic event. Although all stoke patients in our study received aspirin (150mg/d) and statin (atorvastatin 20mg/d) we hypothesized that patients falling under high risk could benefit from treatment with subcutaneous heparin. There were no big studies analyzing the use of heparin in high risk TIAs. In one small trial involving 449 patients, a low-molecular-weight heparin did not reduce the risk of recurrent stroke during the first 14 days after a stroke that was attributed to atrial fibrillation [89]. However, in a large subgroup (3169 patients) of similar patients in a trial of subcutaneous unfractionated heparin, heparin reduced the 14-day risk of ischemic stroke by more than 50 percent, but an increase in brain hemorrhage eliminated this benefit [90]. Given the lower risk of hemorrhage with smaller infarcts [91], the risk of brain hemorrhage is probably greater after a stroke than after a transient ischemic attack, so the net benefit of such therapy after a transient ischemic attack may be greater.

Out of 38 patients who received heparin, 5 (13.2%) developed stroke within 7 days while 14 patients (8.3%) in non heparin group developed stroke. None of the strokes in heparin group were hemorrhagic. Although the proportion of stoke patients in heparin group was higher, it was not statistically significant.

CONCLUSION

- The maximum number of patients were in the age group between 50 and 59 years. (35.92%). Compared to western population, TIA in our study population occurred a decade earlier.

- TIAs occurred more frequently in males (56.3%) than in females (43.7%) showing a general male preponderance of the disease. Males predominated in the age group between 40 and 59 years (70.7%), while females predominated in the age group between 50 and 69 years (61.1%) indicating that females developed TIA at a later age compared to males.

- Common risk factors were hypertension (62.6%), hyperlipidemia (40.7%), diabetes mellitus (44.6%), smoking (45.1%) and alcoholism (35.4%). Modification of lifestyle and proper management of these modifiable risk factors might play a major role in the primary and secondary prevention of ischemic stroke.

- Motor weakness was the commonest clinical presentation and was seen in 65.53% in this study. Speech disturbance was the next common symptom seen in 40.77% (aphasia constituted 16.2% and dysarthria 24.57%).

- There was no significant difference between the proportion of patients with short duration (< 60 min, 102 patients) and long duration (> 60 min, 104 patients) TIAs in our study.
- Our study showed an association between AF and 5 clinical features: (1) age ≥ 60 years, (2) consciousness disturbance, (3) nausea and vomiting, (4) dizziness/vertigo and (5) gait disturbance during TIA. Consciousness disturbance and gait disturbance were more frequent in AF group than in non-AF group.
- 22.2% of patients without prior history of stroke had positive CT imaging after TIA.
- There was no significant difference in duration of TIA between the CT positive and CT negative group.
- There was a significant association between older age, hypertension and Carotid stenosis (>50%) and presence of infarct in CT.
- Infarction prevalence was slightly higher in carotid than vertebrobasilar patients (23.3% and 21.5%) but it was not statistically significant.
- According to $ABCD^2$ score 62 (30.1%) patients were in low risk group, 84 (40.8%) in moderate risk, while 60 (29.1%) were in high risk group in our study.
- The proportion of patients with a score of 7 (14.5%) was higher in our study.

- The overall risk of developing stroke at 2 days, 7 days and 90 days were 5.3%, 9.2% and 11.6% respectively in our study. The risk at the end of 30 days was same as 7 day risk.

- Patients with score between 0 and 3 did not develop stoke within 90 days. And there was no mortality within 90 days in our study.

- Administration of heparin did not significantly alter the development of stroke at 7 days in high risk group.

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Clinical and Imaging Features of Transient Ischaemic Attack and the Utility of ABCD^2 Score

No.	

PROFORMA

Name: **Age/Sex**: **IP No**:

Address: **Phone No:**

Presenting symptoms:

• Consciousness disturbance Ye s No

• Speech confused or word-finding difficulty

hoarse

• Visual could not see from one eye when good eye covered

could not see half of objects with one eye or both eyes open

diplopia/double vision

completely blind

• Dizziness/vertigo Ye s No

• Imbalance Ye s No

• Numbness Ye s No

• Limb weakness and/or numbness

• Facial droop or numbness

• Gait disturbance Ye s No

• LOC Ye s No

Other symptoms :

Duration of symptoms:

Past and Personal History:

History of stroke : Ye s No

Hypertension : Ye s No

Diabetes mellitus : Ye s No

Hyperlipidemia : Ye s No

Smoking: Ye s No

Drugs/Medications: Ye s No

Ischemic Heart Disease Ye s No

Neurological Examination :

Cardiovascular Examination: B.P:

Pulse:

Carotids:

Peripheral Vessels:

Heart sounds :

Other System Examination:

ABCD^2 Score:

Investigations:

• Hb: TC: DC: P L E

• ESR

• Fasting blood glucose

• Blood urea: mg/dl Serum creatinine: mg/dl

• Electrolytes:

• Fasting lipid profile: Total Cholesterol:

Total:

HDL:

Triglycerides:

Imaging:

CT Brain:

MRI Brain:

Transcranial Doppler:

Carotid and Vertebral Doppler:

Intimal-medial thickness (IMT)

TREATMENT:

Heparin:

LMWH / Unfractionated, Duration of treatment:

Antiplatelets Statin

OUTCOME :

Clinical and Imaging Features of Transient Ischaemic Attack and the Utility of ABCD^2 Score

No.	

PROFORMA

Name: **Age/Sex**: **IP No**:

Address: **Phone No:**

Presenting symptoms:

• Consciousness disturbance Ye s No

• Speech confused or word-finding difficulty

hoarse

• Visual could not see from one eye when good eye covered

could not see half of objects with one eye or both eyes open

diplopia/double vision

completely blind

• Dizziness/vertigo Ye s No

• Imbalance Ye s No

• Numbness Ye s No

• Limb weakness and/or numbness

• Facial droop or numbness

• Gait disturbance Ye s No

• LOC Ye s No

Other symptoms :

Duration of symptoms:

Past and Personal History:

History of stroke : Ye s No

Hypertension : Ye s No

Diabetes mellitus : Ye s No

Hyperlipidemia : Ye s No

Smoking: Ye s No

Drugs/Medications: Ye s No

Ischemic Heart Disease Ye s No

Neurological Examination :

Cardiovascular Examination: B.P:

Pulse:

Carotids:

Peripheral Vessels:

Heart sounds :

Other System Examination:

ABCD^2 Score:

Investigations:

• Hb: TC: DC: P L E

• ESR

• Fasting blood glucose

• Blood urea: mg/dl Serum creatinine: mg/dl

• Electrolytes:

• Fasting lipid profile: Total Cholesterol:

Total:

HDL:

Triglycerides:

Imaging:

CT Brain:

MRI Brain:

Transcranial Doppler:

Carotid and Vertebral Doppler:

Intimal-medial thickness (IMT)

TREATMENT:

Heparin:

LMWH / Unfractionated, Duration of treatment:

Antiplatelets Statin

OUTCOME :